

REPORT NUMBER: CAL-90-N02

**NEW CAR ASSESSMENT PROGRAM (NCAP)  
FRONTAL BARRIER IMPACT TEST**

**TOYOTA MOTOR CORPORATION  
1990 4-RUNNER 4x4  
4-DOOR M.P.V.**

NHTSA NUMBER: ML5101

CALSPAN TEST NUMBER: 7776-2

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November 29, 1989



FINAL REPORT

PREPARED FOR:

U. S. Department of Transportation  
National Highway Traffic Safety Administration  
Office of Market Incentives  
400 Seventh Street, S.W.  
Room No. 5313 (NRM-20)  
Washington, DC 20590

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**TECHNICAL REPORT STANDARD TITLE PAGE**

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| <p>16. Abstract</p> <p>A frontal barrier impact test of a 1990 Toyota 4-Runner 4x4 was conducted at Calspan Advanced Technology Center crash test facility in Buffalo, New York on November 29, 1989.</p> <p>The impact speed was 34.9 mph and the ambient temperature at the barrier face was 25°F. The maximum post-test vehicle crush was 21.4 inches. The test vehicle was equipped with a manual 3-point continuous belt system at each of the front outboard positions.</p> <p>With regard to FMVSS 208-"Occupant Crash Protection," injury criteria, both the driver and passenger dummies appear to exceed the maximum HIC but did satisfy the chest and femur requirements.</p> |  |                                                             |                                                                                                                                                                                                                                           |                                                                                    |  |
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Section I  
PURPOSE AND TEST PROCEDURE

This 35 mph frontal barrier impact test is part of the Composite FY 90 Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-87-D-02012. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for an impact speed in excess of the current 30 mph requirements.

The 35 mph frontal barrier impact test was conducted in accordance with the Office of Market Incentives (OMI) Laboratory Indicant Test procedure.

## Section 2

### SUMMARY OF TEST NUMBER ML5101

A load cell barrier consisting of 36 load cells was impacted by a 1990 Toyota 4-Runner M.P.V. at a velocity of 34.9 mph. The test was performed at the Calspan Corporation Advanced Technology Center on November 29, 1989. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

The frontal barrier impact event was documented by one real-time camera and 13 high-speed cameras. Camera locations and other pertinent camera information can be found in this report.

Two Part 572, 50th percentile male anthropomorphic test devices (ATDs), were placed in the driver and right-front passenger seating positions according to dummy placement instructions specified in the Laboratory Indicant Test Procedure.

Both ATDs were fully instrumented with head and chest triaxial accelerometers and right/left femur load cells. Seat belt load cells were also on the driver's and passenger's lap and shoulder belts to measure dummy torso and pelvic section loading. The driver ATD (Serial No. 357) and the right-front passenger ATD (Serial No. 358) had been used in one previous test (ML5400) and the Injury Criteria Values were not exceeded in that test. Certification details, along with instrumentation calibration data, are found in Appendix C.

The 55 channels of data were recorded on six 14-channel FM tape recorders. Appendix B contains the vehicle, load cell barrier and dummy response data traces. The driver and passenger ATD's both appear to exceed the maximum HIC as specified by FMVSS 208. Prior to impact, tape recorder #6 blew a fuse resulting in a loss of data for load cells C7-D9. Data for these load cells are not available. After impact, load cells B4 and B6 had a substantial offset due to the impact sustained from the left and right frame rails. Accelerometer 3(x) experienced a cut wire during impact.

The driver's head struck the steering wheel rim; the HIC was 1305.6. The maximum chest deceleration over 3 milliseconds was 47.6 g's and femur loads were 429.5 and 1428.9 pounds.

The right front passenger's HIC was 1133.4 and maximum chest deceleration over 3 milliseconds was 47.2 g's. Femur loads were 820.9 and 319.6 pounds.

Table 1

## GENERAL TEST AND VEHICLE PARAMETER DATA

Vehicle Year/Make/Model/Body Style: 1990 Toyota 4-Runner 4x4 4-Door M.P.V.

NHTSA No.: ML5101 VIN.: JT3RN37W1L0000795

Body Color: White Date Of Manufacture: 5-89

Engine: 4 Cylinders; 144.4 C.I.D.; 2.4 Liters; - CC  
X Gas; - Diesel; - Turbocharged  
X Longitudinal; - Transverse

Transmission: 3 Speed; - Manual; X Automatic; X Overdrive

Final Drive: - Front Wheel; - Rear Wheel; X Four Wheel

Date Received: 10-5-89 Odometer Reading: 73.2

- A/C; - P/S; X P/B; X P/wdo.; - Tilt Wheel  
- P/seats; X Cruise Control

Type of Occupant Restraint: 3-point continuous belt system

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): Front 26 psi, Rear 35 psi

Recommended Tire Size: P225/75R15

Recommended Cold Tire Pressure: Front 26 psi, Rear 35 psi

Tires on Vehicle: P225/75R15; Manufacturer: Dunlop

Number of Occupants: 2 Front; 3 Rear; - 3rd Seat; 5 TOTAL

Type of Front Seats: X Bucket; - Bench; - Split Bench

Type of Front Seat Back: - Fixed; X Adj. With X Lever - Rot. Knob

Vehicle Capacity Weight (VCW) = 1050 lbs. (A)

No. of Occupants x 150 lbs. = 750 lbs. (B)

Rated Cargo and Luggage

Weight (RCLW) A-B = 300 lbs.

GVWR 5350 lbs. GAWR: Front 2600 lbs. Rear 3000 lbs.

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (WITH MAXIMUM FLUIDS) = UDW:

Right Front = 1040 lbs.      Right Rear = 940 lbs.  
 Left Front = 970 lbs.      Left Rear = 910 lbs.  
 TOTAL FRONT WEIGHT = 2010 lbs.    ( 52 % of Total Vehicle Weight)  
 TOTAL REAR WEIGHT = 1850 lbs.    ( 48 % of Total Vehicle Weight)  
 TOTAL DELIVERY WEIGHT = 3860 lbs.

CALCULATION FOR TARGET TEST WEIGHT:

UDW = Unloaded Delivered Weight ( 3860 lbs.)  
 VCW = Vehicle Capacity Weight ( 1050 lbs.)  
 DSC = Designated Seating Capacity ( 5 )  
 RCLW = VCW - 150 (DSC) = 300 lbs.  
 Target Test Weight = UDW + RCLW + (2 dummies x 164 lbs./dummy)  
 Target Test Weight = 4488 lbs.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 82 POUNDS CARGO:

Right Front = 1040 lbs.      Right Rear = 1270 lbs.  
 Left Front = 990 lbs.      Left Rear = 1230 lbs.  
 TOTAL FRONT WEIGHT = 2030 lbs.    ( 45 % of Total Vehicle Weight)  
 TOTAL REAR WEIGHT = 2500 lbs.    ( 55 % of Total Vehicle Weight)  
 TOTAL TEST WEIGHT = 4530 lbs.  
 Weight of ballast secured in vehicle trunk area = 250 lbs.

VEHICLE ATTITUDE (all dimensions in inches):

Delivered Attitude:    RF 35.3    LF 35.6    RR 34.2    LR 34.3  
 Test Attitude:        RF 34.5    LF 34.5    RR 31.6    LR 31.6  
 Wheel Base:    103.2 in.;    C.G. = 56.9 in. rearward of front wheel C/L  
 Remarks: Fuel tank is located forward of rear axle.

Table 1

## GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

POST-IMPACT DATA:

Type of Test: Frontal Barrier Impact Angle: 0°  
 Date of Test: November 29, 1989 Time of Test: 13:25  
 Ambient Temperature: 25 °F at impact area  
 Temperature in Occupant Compartment: 70 °F  
 Windshield Molding Temperature: 68 °F  
 Required Impact Velocity Range: 35.5 to 34.5 mph  
 Impact Velocity: primary = 34.9 mph, secondary = 34.9 mph  
 Distance From Front Bumper to Barrier Face When  
     Entering Speed Trap: 52 inches  
     Exiting Speed Trap: 12 inches

VEHICLE REBOUND AND CRUSH (inches):

Vehicle Length: Pre-test = R 173.7 L 176.5 L 174.0  
                   Post-test = R 152.6 L 155.1 L 153.2  
                   Crush = R 21.1 L 21.4 L 20.8

Distance from front of test vehicle to point of impact:

R 23.6" C 24.0" L 24.3"

VISIBLE DUMMY CONTACT POINTS:

|            | <u>Driver</u>             | <u>Passenger</u>  |
|------------|---------------------------|-------------------|
| Head       | <u>Steering Hub</u>       | <u>Right Knee</u> |
| Chest      | <u>Lower Steering Rim</u> | <u>No Contact</u> |
| Abdomen    | <u>No Contact</u>         | <u>No Contact</u> |
| Left Knee  | <u>Dash Panel</u>         | <u>Dash Panel</u> |
| Right Knee | <u>Dash Panel</u>         | <u>Dash Panel</u> |

Table 1  
GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

|              | <u>Front</u>    |                 | <u>Rear</u> |              |
|--------------|-----------------|-----------------|-------------|--------------|
|              | <u>Left</u>     | <u>Right</u>    | <u>Left</u> | <u>Right</u> |
| Door Opening | <u>operable</u> | <u>operable</u> | <u>-</u>    | <u>-</u>     |

| <u>Seat Movement</u> | <u>Front</u> |              | <u>Rear</u> |              |
|----------------------|--------------|--------------|-------------|--------------|
|                      | <u>Left</u>  | <u>Right</u> | <u>Left</u> | <u>Right</u> |
| Seat Back Failure    | <u>none</u>  | <u>none</u>  | <u>-</u>    | <u>-</u>     |
| Seat Shift (in.)     | <u>0.0</u>   | <u>0.0</u>   | <u>-</u>    | <u>-</u>     |

Glazing Damage

Backlight/Windshield: Windshield sustained stress cracks but remained intact.

Section 3  
OMI FINAL DATA

Occupant and Vehicle Information

I.    OMI DATA

1.    Dummy Injury Criteria Data Summary
2.    Dummy Positioning Data
3.    Seat Belt Positioning Data
4.    Seat Belt Performance Assessment Data
5.    Driver Dummy to Steering Column Dimensions
6.    Camera Locations
7.    Vehicle Target Locations

II.   OVR DATA

1.    Load Cell Barrier Data
2.    Vehicle Accelerometer Data
3.    Test Vehicle Measurements

Table 2  
DUMMY INJURY CRITERIA VALUES

NHTSA No.: ML5101      Vehicle: 1990 Toyota 4-Runner 4x4

|                         | MAXIMUM HEAD ACCELERATION (g's) |      |      |       |
|-------------------------|---------------------------------|------|------|-------|
|                         | X                               | Y    | Z    | R     |
| Position #1 - Driver    | -181.0                          | 27.6 | 82.4 | 199.6 |
| Position #2 - Passenger | -62.9                           | 38.5 | 99.9 | 102.3 |

|                         | MAXIMUM CHEST ACCELERATION (g's) |       |      |      |
|-------------------------|----------------------------------|-------|------|------|
|                         | X                                | Y     | Z    | R    |
| Position #1 - Driver    | -54.6                            | -14.3 | 21.7 | 47.6 |
| Position #2 - Passenger | -46.2                            | 42.6  | 22.2 | 47.2 |

The maximum chest resultant acceleration is defined as the maximum acceleration which exceeds 0.003 seconds in duration.

|                         | MAXIMUM FORCE - FEMUR LOAD (lbs.) |             |
|-------------------------|-----------------------------------|-------------|
|                         | LEFT FEMUR                        | RIGHT FEMUR |
| Position #1 - Driver    | 429.5                             | 1428.9      |
| Position #2 - Passenger | 820.9                             | 319.6       |

|                         | MAXIMUM FORCE - SEAT BELT LOADS (lbs.) |                              |                             |
|-------------------------|----------------------------------------|------------------------------|-----------------------------|
|                         | SHOULDER STRAP<br>UPPER BELT LOAD      | LAP STRAP<br>RIGHT BELT LOAD | LAP STRAP<br>LEFT BELT LOAD |
| Position #1 - Driver    | 1817.8                                 | -                            | 1903.8                      |
| Position #2 - Passenger | 1835.2                                 | 1828.6                       | -                           |

|                         | HEAD INJURY CRITERIA (HIC) |                      |                      |                                                          |
|-------------------------|----------------------------|----------------------|----------------------|----------------------------------------------------------|
|                         | HIC                        | t <sub>1</sub> (SEC) | t <sub>2</sub> (SEC) | Average Acceleration<br>t <sub>1</sub> TO t <sub>2</sub> |
| Position #1 - Driver    | 1305.6                     | .05745               | .09165               | 68.0                                                     |
| Position #2 - Passenger | 1133.4                     | .05872               | .07830               | 80.4                                                     |

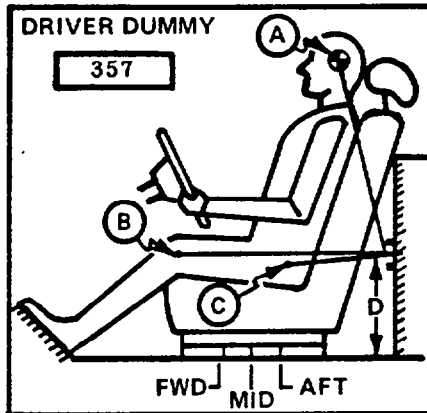
HIC is as defined in FMVSS 208. The maximum time interval from t<sub>1</sub> to t<sub>2</sub> is 36 milliseconds.

Figure 1

PART 572 DUMMY IN-VEHICLE POSITION

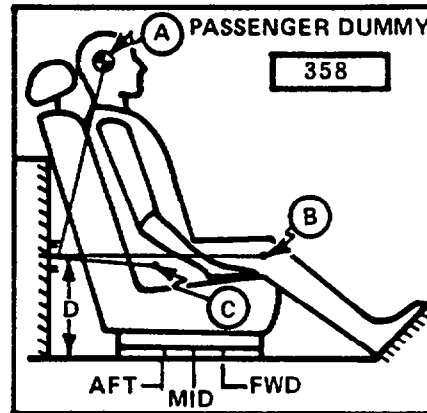
Test No.: ML5101 Vehicle: 1990 Toyota 4-Runner 4x4

|                      |                       |                               |
|----------------------|-----------------------|-------------------------------|
| <u>SEAT TYPE:</u>    | <u>ADJUSTER TYPE:</u> | <u>BUCKET SEAT BACK TYPE:</u> |
| <u>-</u> Bench       | <u>X</u> Manual       | <u>-</u> Fixed                |
| <u>X</u> Bucket      | <u>-</u> Power        | <u>X</u> Adjustable Reclining |
| <u>-</u> Split Bench |                       |                               |

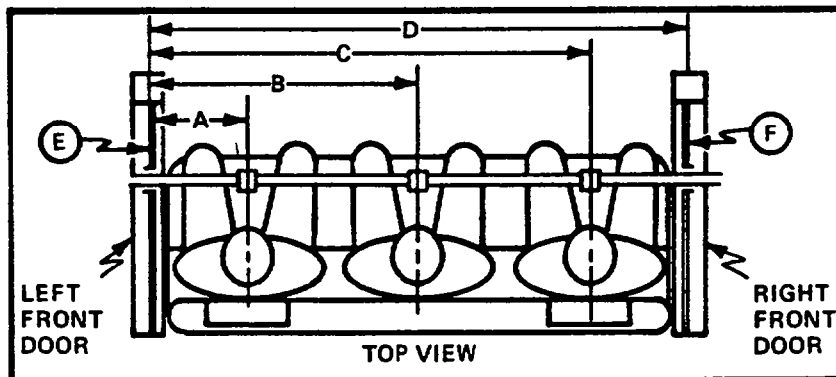


MEASUREMENT LOCATION

- A - Head Target
- B - Knee Joint
- C - Approximate 'H' Point
- D - Sill to Reference Point



|                                       |                                       |
|---------------------------------------|---------------------------------------|
| A = <u>20.3</u> in. <u>9</u> Degrees  | A = <u>21.0</u> in. <u>10</u> Degrees |
| B = <u>22.6</u> in. <u>96</u> Degrees | B = <u>22.8</u> in. <u>98</u> Degrees |
| C = <u>9.3</u> in. <u>137</u> Degrees | C = <u>9.2</u> in. <u>137</u> Degrees |
| D = <u>17.0</u> in.                   | D = <u>17.0</u> in.                   |



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DUMMY ID

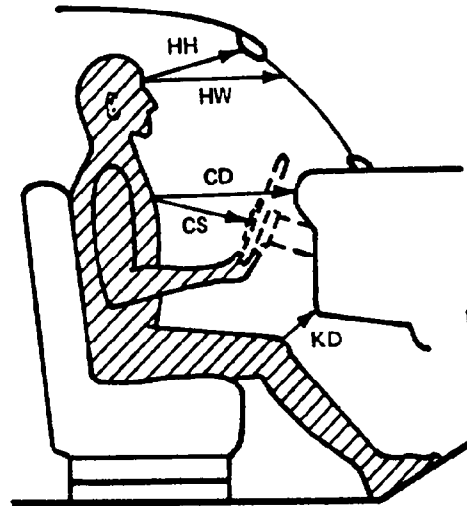
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|                                                          |                 |
|----------------------------------------------------------|-----------------|
| A = Left Door to Driver Centerline                       | <u>12.1</u> in. |
| B = Left Door to Center Passenger Centerline             | <u>-</u> in.    |
| C = Left Door to Right Passenger Centerline              | <u>39.2</u> in. |
| D = Left Door to Right Door                              | <u>50.9</u> in. |
| E,F = Window Glass Height (Right and Left Must Be Equal) | <u>12.8</u> in. |

Figure 2

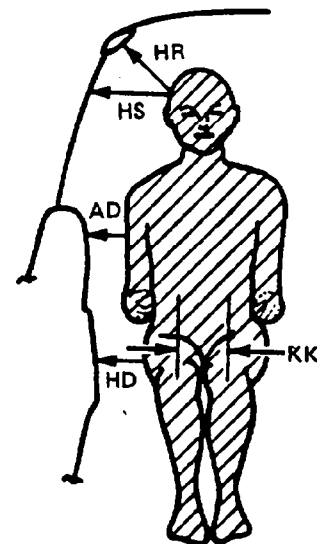
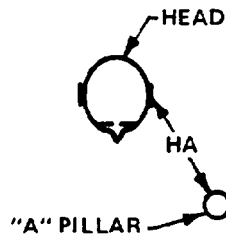
OCCUPANT CLEARANCE DIMENSIONS

|     | DRIVER   | PASSENGER |
|-----|----------|-----------|
| HH  | 15.6     | 15.7      |
| HW  | 19.4     | 18.8      |
| CD  | 22.4     | 23.6      |
| CS  | 13.3     | -         |
| KDL | 6.9      | 7.9       |
| KDR | 6.3      | 8.1       |
| SA  | See note | See note  |
| TA  | 20°      | 19°       |



HH = Head to Windshield Header  
 HW = Head to Windshield  
 CD = Chest to Dash  
 CS = Chest to Steering Wheel  
 KD(L/R) = Knee to Dash (Left/Right)  
 SA = Seat Back Angle  
 TA = Torso Angle

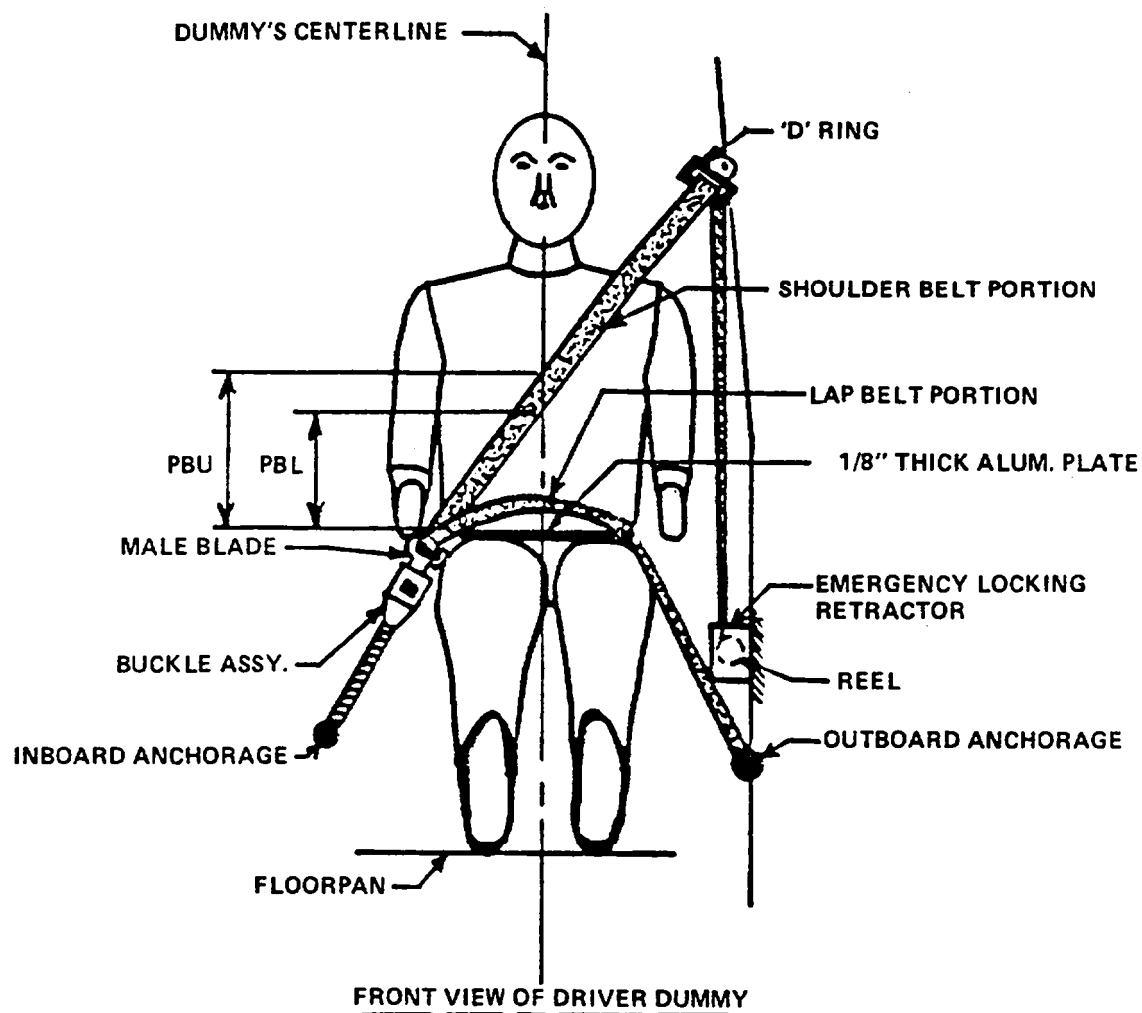
HA = Head Target to "A" Pillar  
 HR = Head to Side Roof  
 HS = Head to Side Window  
 AD = Arm to Door  
 HD = Hip to Door  
 KK = Knee to Knee



|    | DRIVER | PASSENGER |
|----|--------|-----------|
| HR | 7.1    | 6.9       |
| HS | 8.9    | 8.7       |
| AD | 3.8    | 3.4       |
| HD | 5.9    | 5.2       |
| KK | 9.7    | 9.6       |
| HA | 18.8   | 18.4      |

Note: Seat was positioned as recommended by manufacturer.

Figure 3  
SEAT BELT POSITIONING DATA



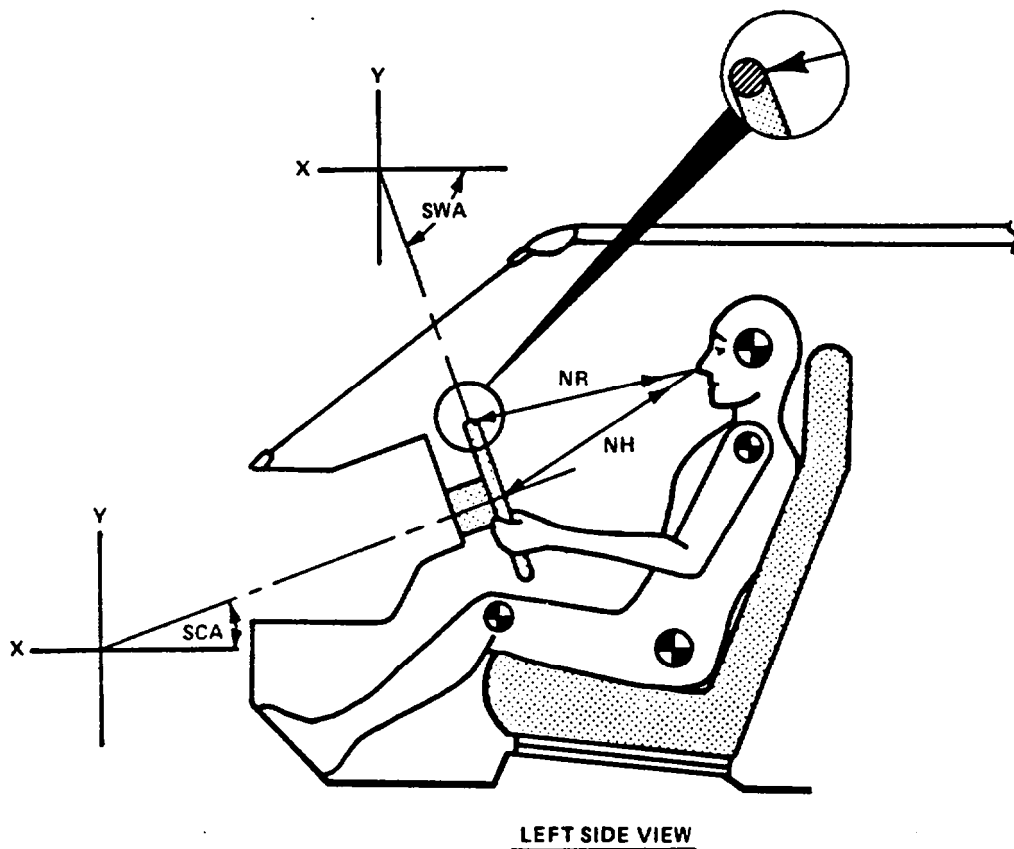
|                                                             | DRIVER DUMMY<br>(inches) | PASSENGER DUMMY<br>(inches) |
|-------------------------------------------------------------|--------------------------|-----------------------------|
| <u>PBU</u> -- Top surface of alum. plate to upper edge      | 12.0                     | 12.0                        |
| <u>PBL</u> -- Top surface of alum. plate to belt lower edge | 8.5                      | 8.5                         |
| <u>LAP BELT TENSION</u>                                     | 2 lbs                    | 2 lbs                       |
| <u>SHOULDER BELT TENSION</u>                                | —                        | —                           |

Table 3  
SEAT BELT PERFORMANCE ASSESSMENT TEST DATA

| <u>BELT LENGTH DATA:</u>                                                                   | <u>Driver</u>    | <u>Passenger</u> |
|--------------------------------------------------------------------------------------------|------------------|------------------|
| Belt length from trim panel exit to bolt hole anchor point for continuous webbing systems. | <u>77.5</u>      | <u>77.5</u>      |
| Shoulder belt length as measured on Part 572 Dummy.                                        | <u>32.5</u>      | <u>32.5</u>      |
| Lap belt length as measured on Part 572 Dummy.                                             | <u>33.0</u>      | <u>33.0</u>      |
| <u>SHOULDER BELT SPOOL-OFF DATA:</u>                                                       |                  |                  |
| As determined by film analysis.                                                            | <u>N/A</u>       | <u>N/A</u>       |
| As determined mechanically.                                                                | <u>N/A</u>       | <u>3.0"</u>      |
| As determined electronically.                                                              | <u>N/A</u>       | <u>4.6"</u>      |
| <u>BELT STRETCH DATA:</u>                                                                  |                  |                  |
| Measured electronically between shoulder belt load cell and the "D" ring.                  | <u>.5 in/ft</u>  | <u>.96 in/ft</u> |
| Measured mechanically                                                                      | <u>0.0 in/ft</u> | <u>0.0 in/ft</u> |

Figure 4

DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSY. REFERENCE DIMENSIONS



|            |                                                                                | MEASUREMENTS |         |
|------------|--------------------------------------------------------------------------------|--------------|---------|
| <u>NR</u>  | -- Distance from tip of dummy's nose to Top Rear surface of steering wheel rim | 16.5         | Inches  |
| <u>NH</u>  | -- Distance from tip of dummy's nose to center of steering column hub          | 17.3         | Inches  |
| <u>SCA</u> | -- Angle of steering column relative to the horizontal X axis                  | -67          | Degrees |
| <u>SWA</u> | -- Angle of steering wheel relative to the horizontal X axis                   | 23           | Degrees |

Figure 5  
CAMERA POSITIONS FOR FRONTAL IMPACTS

NOTE: Camera Information Shown on Table 4

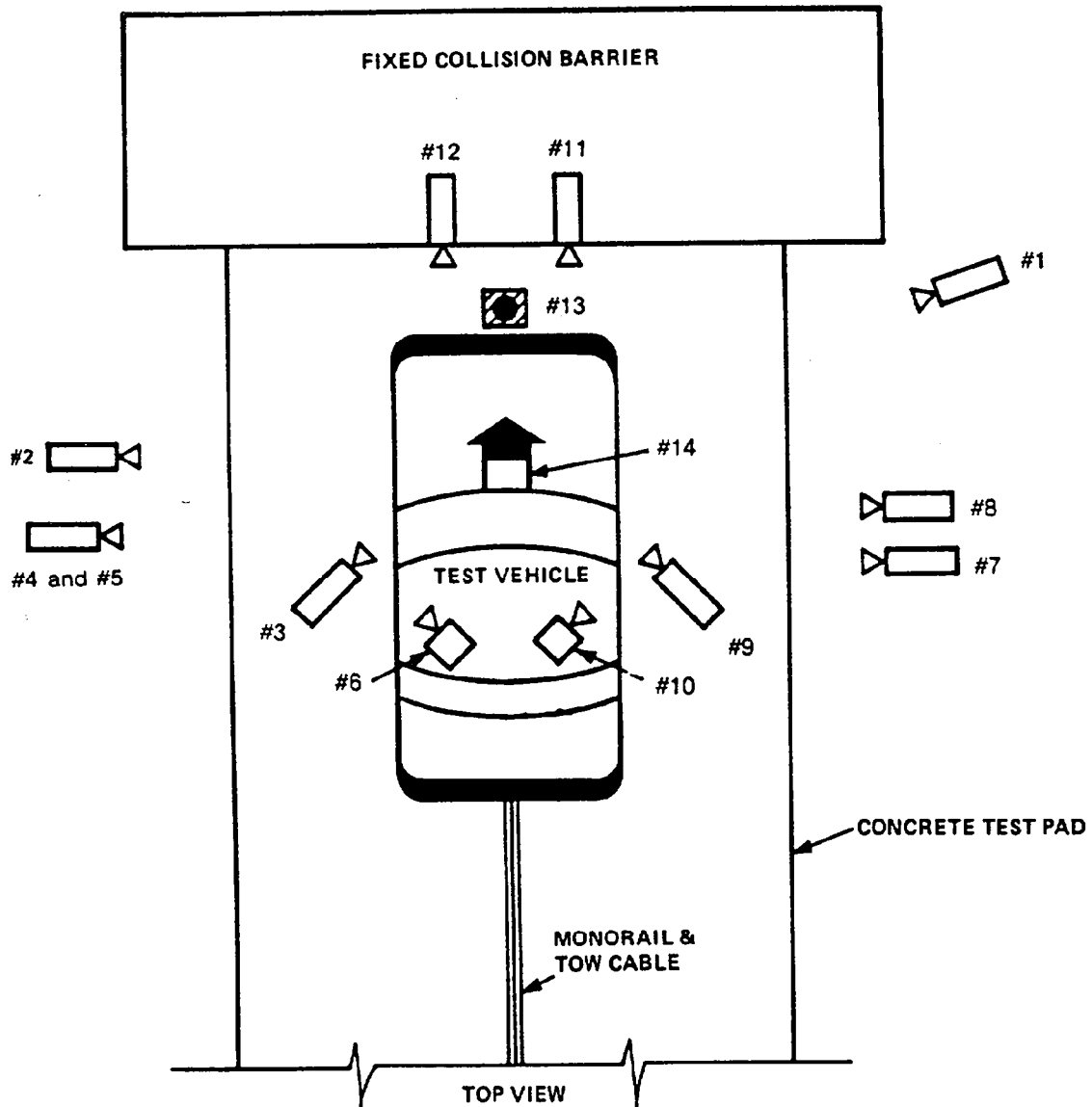


Table 4

## HIGH-SPEED CAMERA LOCATIONS

| Test No. ML5101 |                             | Vehicle: 1990 Toyota 4-Runner 4x4 |     |     |               |                           |           |             |
|-----------------|-----------------------------|-----------------------------------|-----|-----|---------------|---------------------------|-----------|-------------|
| CAMERA NO.      | VIEW                        | CAMERA POSITIONS (in)*            |     |     | ANGLE** (deg) | FILM PLANE TO HEAD TARGET | LENS (mm) | SPEED (fps) |
|                 |                             | X                                 | Y   | Z   |               |                           |           |             |
| 1               | Real-Time Camera            | -                                 | -   | -   | -             | -                         | -         | 24          |
| 2               | Overall Left Side           | 249                               | 57  | 42  | -3            | 233                       | 13        | See Note    |
| 3               | Driver and Interior View    | 117                               | 94  | 78  | -16           | 101                       | 13        | 880         |
| 4               | Steering Column (Bottom)    | 301                               | 77  | 46  | -4            | 285                       | 25        | 550         |
| 5               | Steering Column (Top)       | 301                               | 77  | 70  | -7            | 285                       | 25        | 570         |
| 6               | Lap Belt N/A                | -                                 | -   | -   | -             | -                         | 8         | 760         |
| 7               | Overall Right Side          | 236                               | 72  | 42  | -4            | 220                       | 13        | 750         |
| 8               | Right Side View             | 310                               | 51  | 42  | -1            | 294                       | 25        | 790         |
| 9               | Passenger and Interior View | 102                               | 101 | 74  | -15           | 86                        | 25        | 620         |
| 10              | Right Belt N/A              | -                                 | -   | -   | -             | -                         | 8         | 680         |
| 11              | Passenger Front View        | 24                                | -5  | 73  | -35°          | -                         | 13        | 590         |
| 12              | Driver Front View           | 24                                | -5  | 73  | -35°          | -                         | 13        | See Note    |
| 13              | Windshield View             | 0                                 | 0   | 126 | -45°          | -                         | 13        | 500         |
| 14              | Pit View of Engine          | 0                                 | 32  | 120 | 90            | -                         | 13        | 900         |

\*X = film plane to monorail centerline  
 Y = film plane to impact location  
 Z = film plane to ground  
 \*\* = referenced to horizontal plane

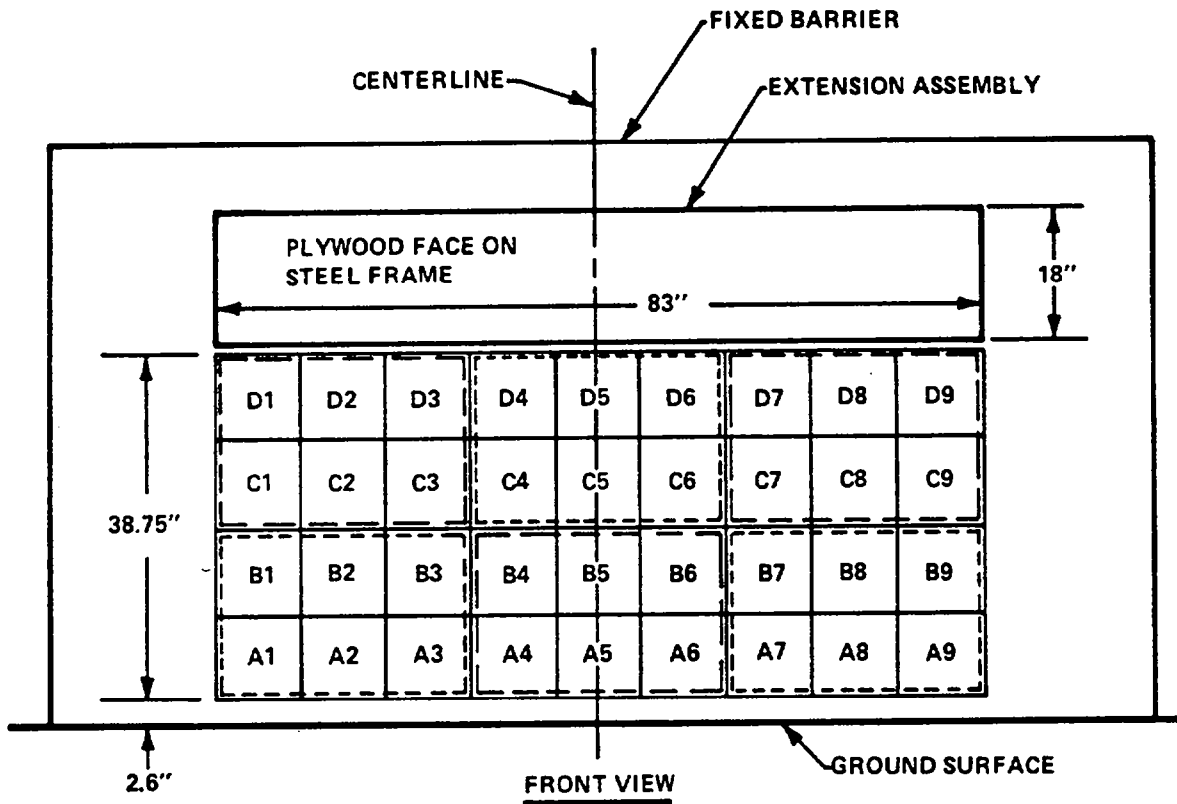
Note: Film speed is not available for this camera.

[illegible]

Figure 7

LOAD CELL LOCATIONS ON FIXED BARRIER

- 36 Load Cells
- 4 Rows
- 9 Columns
- 6 Groupings (6 cells/group)



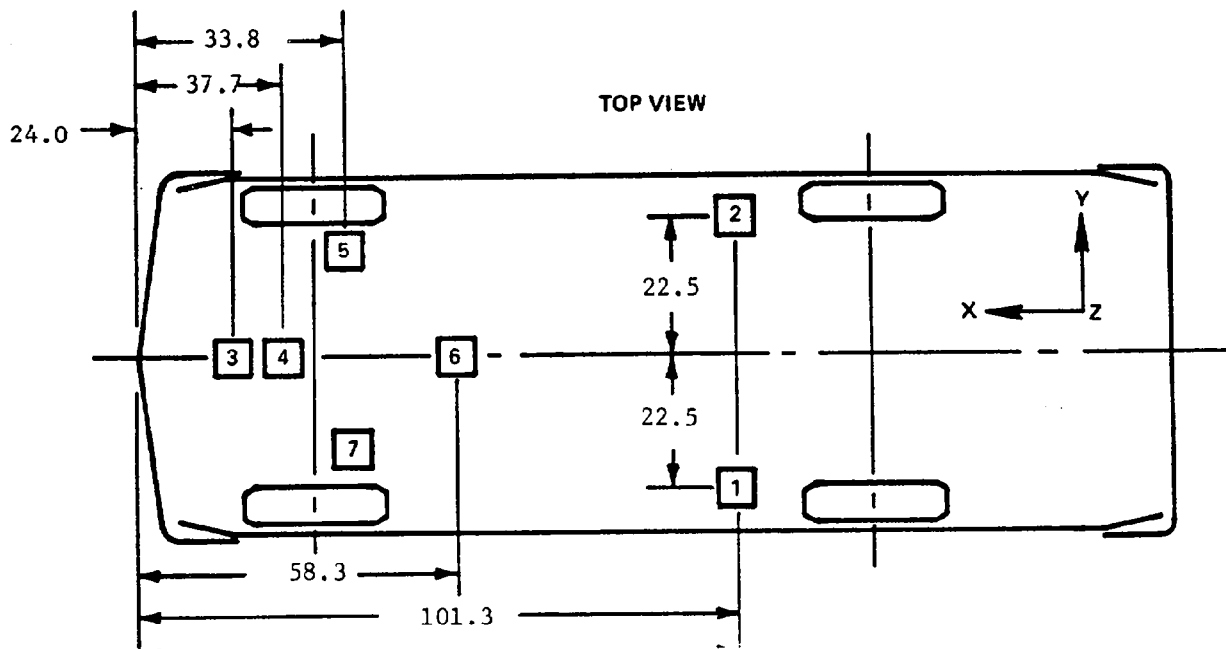
6 GROUPS OF 6 LOAD CELLS EACH

|            |            |            |
|------------|------------|------------|
| Group 4    | Group 5    | Group 6    |
| C1 thru D3 | C4 thru D6 | C7 thru D9 |
| Group 1    | Group 2    | Group 3    |
| A1 thru B3 | A4 thru B6 | A7 thru B9 |

The following data is presented in Appendix B:

- (1) Data from 36 individual load cells
- (2) Total or Sum of 36 individual load cells
- (3) Data from 6 Groupings shown above (6 cells/group)

Figure 8  
VEHICLE ACCELEROMETER LOCATIONS



| ACCELEROMETER<br>NUMBER* | ACCELEROMETER LOCATION      | DIRECTION |   |   |
|--------------------------|-----------------------------|-----------|---|---|
|                          |                             | X         | Y | Z |
| 1                        | Left Rear Seat Crossmember  | X         |   |   |
| 2                        | Right Rear Seat Crossmember | X         |   |   |
| 3                        | Top of Engine               | X         |   |   |
| 4                        | Bottom of Engine            | X         |   |   |
| 5                        | Right Disc Brake Caliper    | X         |   |   |
| 6                        | Instrument Panel            | X         |   |   |
| 7                        | Left Disc Brake Caliper     | X         |   |   |

\*The accelerometer pack number can be correlated with the vehicle response data traces found in Appendix B.

Figure 9  
TEST VEHICLE MEASUREMENTS

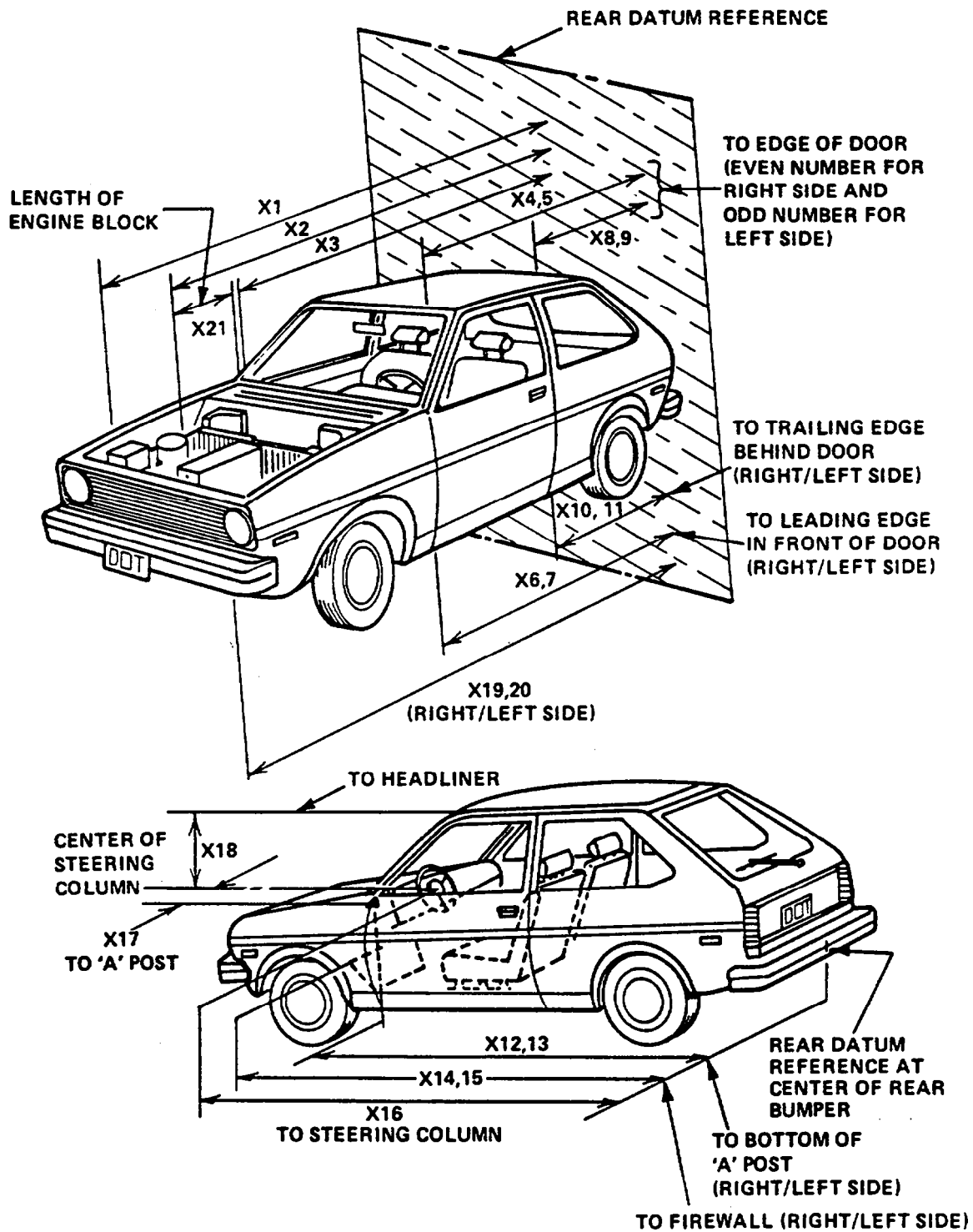


Table 5

## VEHICLE MEASUREMENTS

| No. |                                                              | All Dimensions in Inches |           |             |
|-----|--------------------------------------------------------------|--------------------------|-----------|-------------|
|     |                                                              | Pre-Test                 | Post-Test | Differences |
| X1  | Total Length of Vehicle at Centerline                        | 176.5                    | 155.1     | 21.4        |
| X2  | Rear Surface of Vehicle to Front of Engine                   | 158.3                    | 148.8     | 9.5         |
| X3  | Rear Surface of Vehicle to Firewall                          | 136.7                    | 133.5     | 3.2         |
| X4  | Rear Surface of Vehicle to Upper Leading Edge of Right Door  | 125.6                    | 125.0     | 0.6         |
| X5  | Rear Surface of Vehicle to Upper Leading Edge of Left Door   | 126.2                    | 124.8     | 1.4         |
| X6  | Rear Surface of Vehicle to Lower Leading Edge of Right Door  | 123.5                    | 121.8     | 1.7         |
| X7  | Rear Surface of Vehicle to Lower Leading Edge of Left Door   | 124.0                    | 121.5     | 2.5         |
| X8  | Rear Surface of Vehicle to Upper Trailing Edge of Right Door | 85.1                     | 84.0      | 1.1         |
| X9  | Rear Surface of Vehicle to Upper Trailing Edge of Left Door  | 85.7                     | 84.0      | 1.7         |
| X10 | Rear Surface of Vehicle to Lower Trailing Edge of Right Door | 84.3                     | 82.9      | 1.4         |
| X11 | Rear Surface of Vehicle to Lower Trailing Edge of Left Door  | 85.2                     | 82.7      | 2.5         |
| X12 | Rear Surface of Vehicle to Bottom of "A" Post of Right Side  | 123.3                    | 120.9     | 2.4         |
| X13 | Rear Surface of Vehicle to Bottom of "A" Post of Left Side   | 123.6                    | 120.8     | 2.8         |
| X14 | Rear Surface of Vehicle to Firewall, Right Side              | 135.9                    | 134.2     | 1.7         |
| X15 | Rear Surface of Vehicle to Firewall, Left Side               | 135.7                    | 134.6     | 1.1         |
| X16 | Rear Surface of Vehicle to Steering Column                   | 109.5                    | 109.1     | 0.4         |
| X17 | Center of Steering Column to "A" Post                        | 15.8                     | 15.3      | 0.5         |
| X18 | Center of Steering Column to Headliner                       | 16.9                     | 16.6      | 0.3         |
| X19 | Rear Surface of Vehicle to Right Side of Front Bumper        | 173.7                    | 152.6     | 21.1        |
| X20 | Rear Surface of Vehicle to Left Side of Front Bumper         | 174.0                    | 153.2     | 20.8        |
| X21 | Length of Engine Block                                       | 21.0                     | 21.0      | 0.0         |
| RD  | Rear Surface of Vehicle to Right Side of Dash Panel          | 118.0                    | 117.5     | 0.5         |
| CD  | Rear Surface of Vehicle to Center of Dash Panel              | 118.3                    | 116.6     | 1.7         |
| LD  | Rear Surface of Vehicle to Left Side of Dash Panel           | 118.6                    | 116.5     | 2.1         |

Appendix A

PHOTOGRAPHS

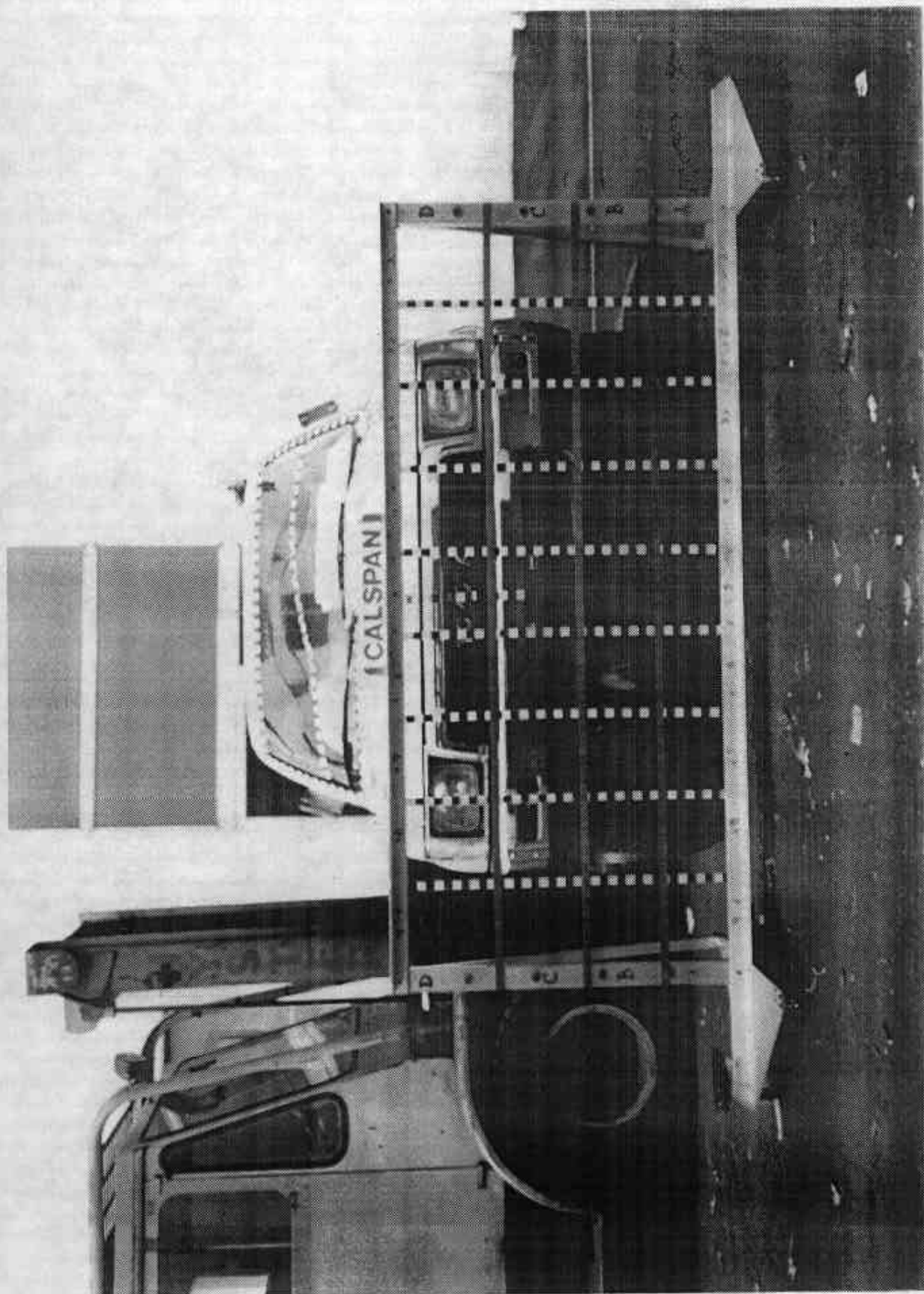


Figure A-1 PRE-TEST LOAD CELL LOCATIONS

A-2

7776-2



Figure A-2 PRE-TEST FRONT VIEW

A-3

7776-2

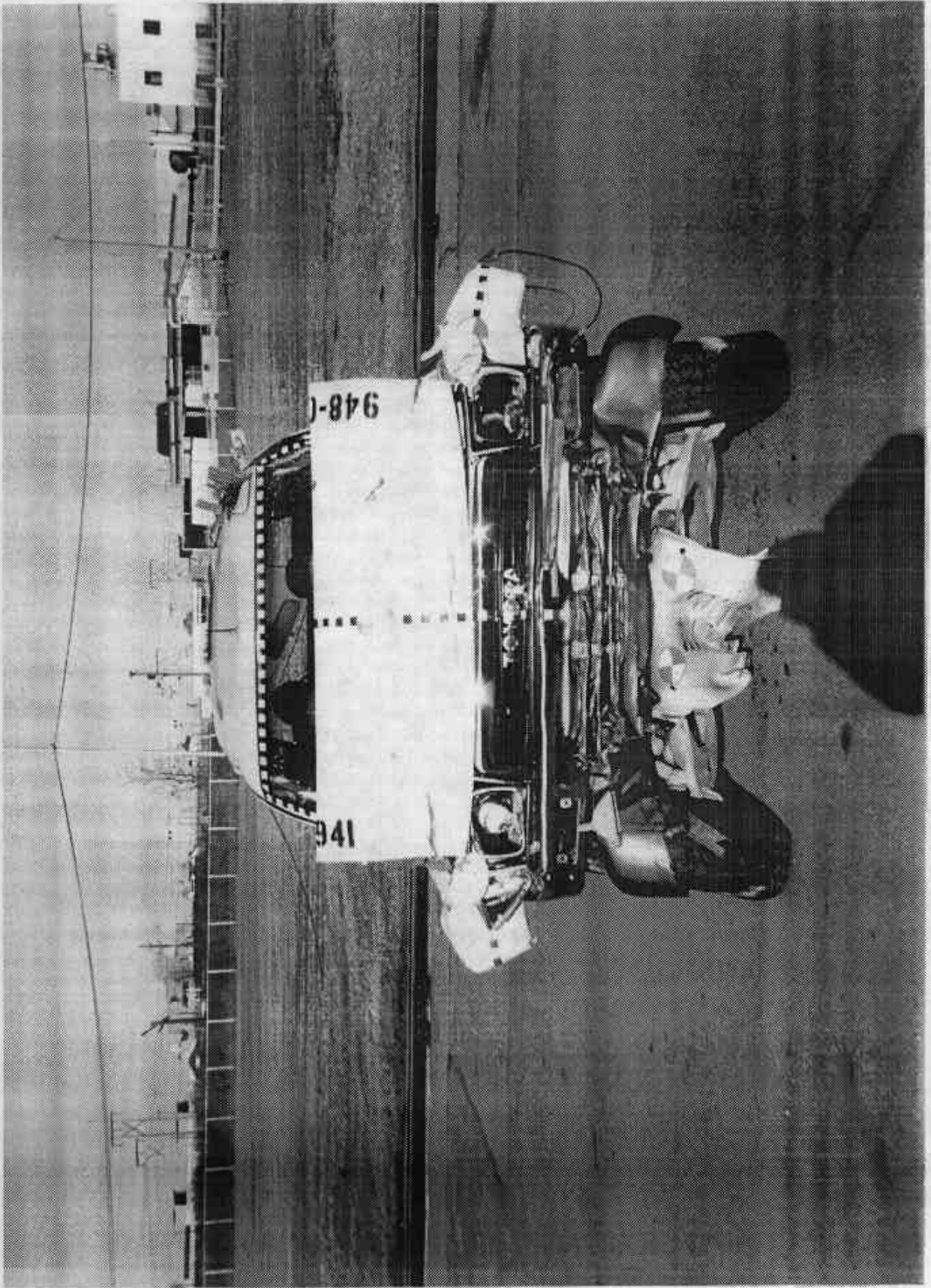


Figure A-3 POST TEST FRONT VIEW

A-4

7776-2

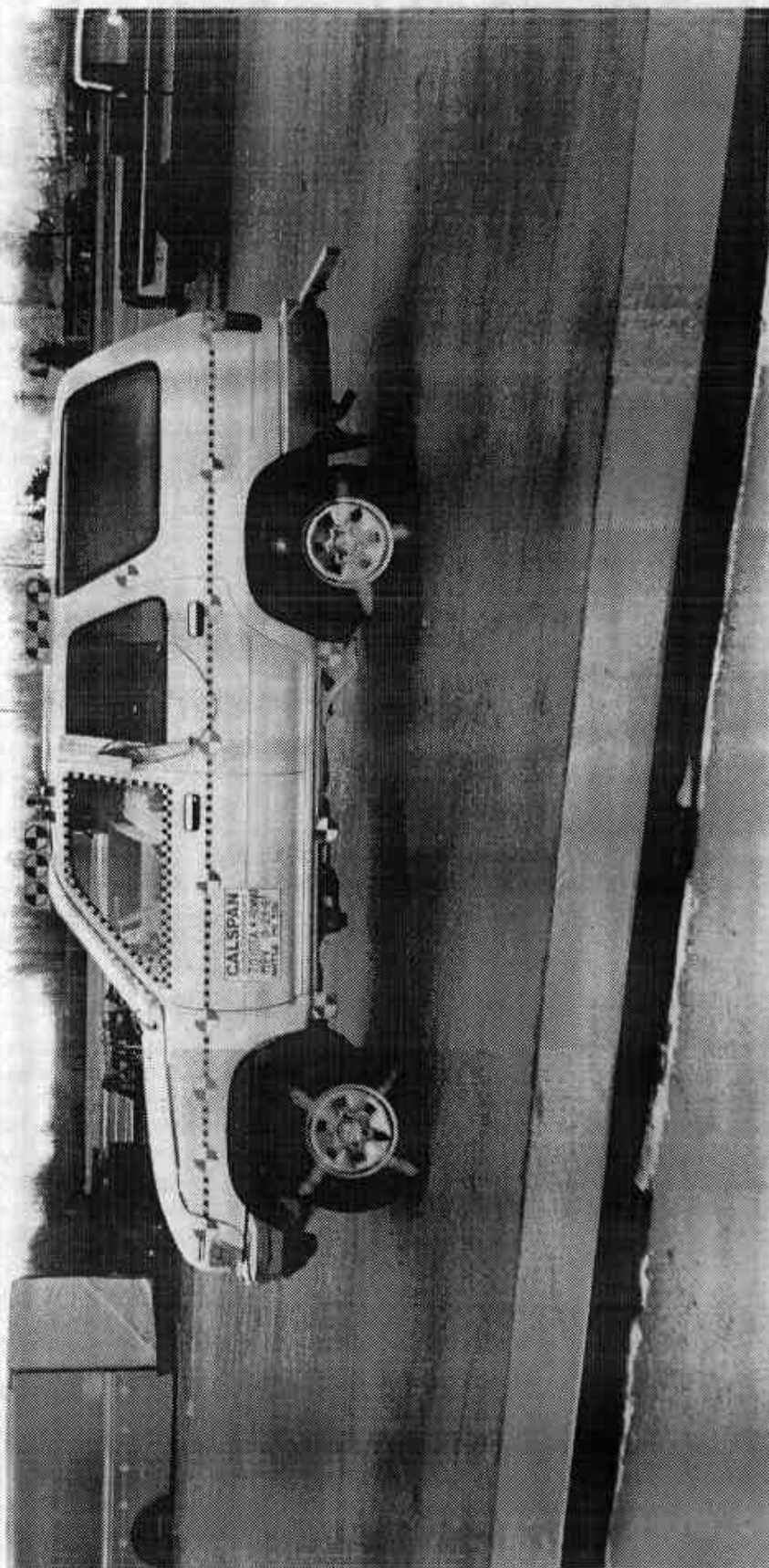


Figure A-4 PRE-TEST LEFT SIDE VIEW

A-5

7776-2

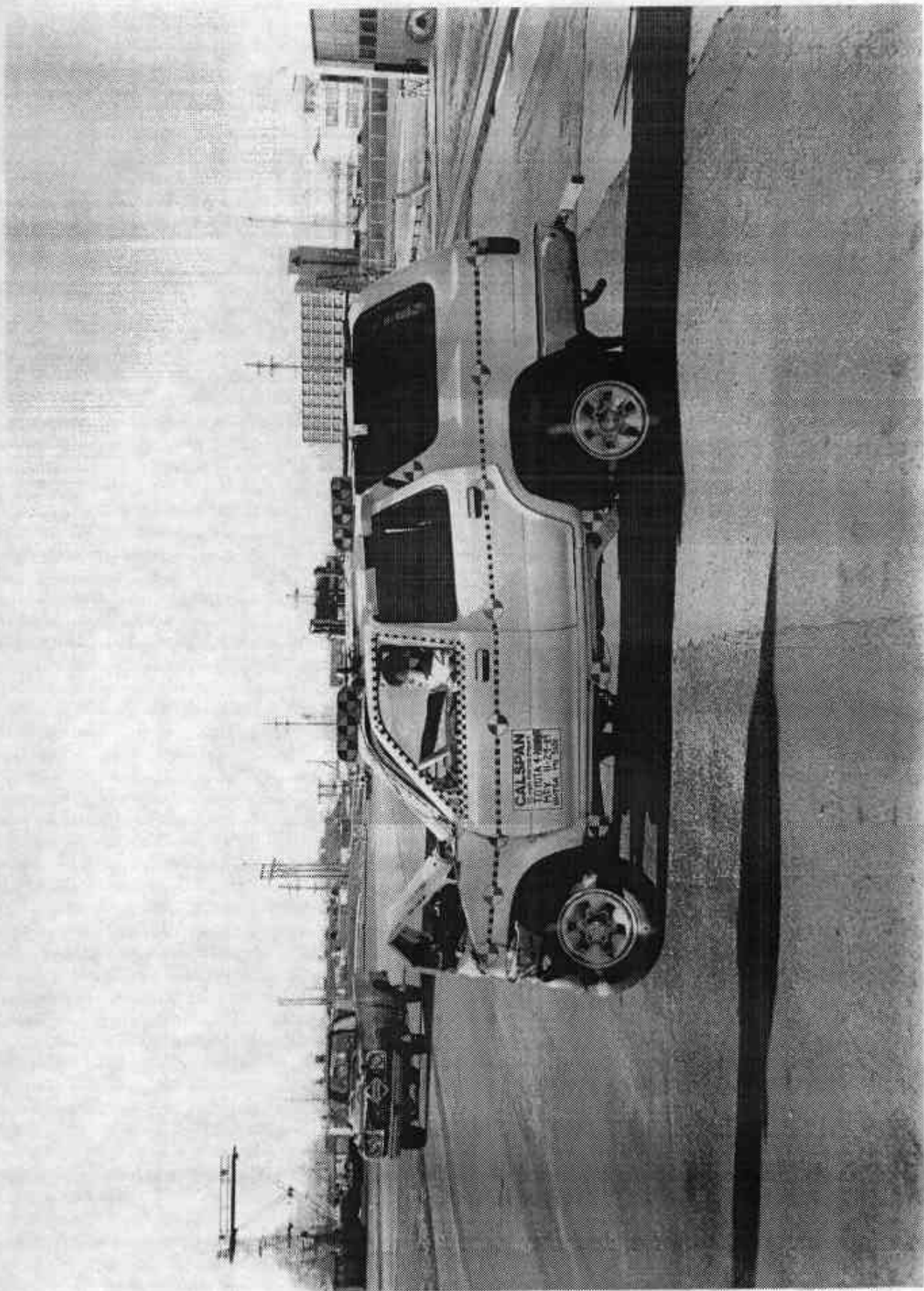


Figure A-5 POST TEST LEFT SIDE VIEW

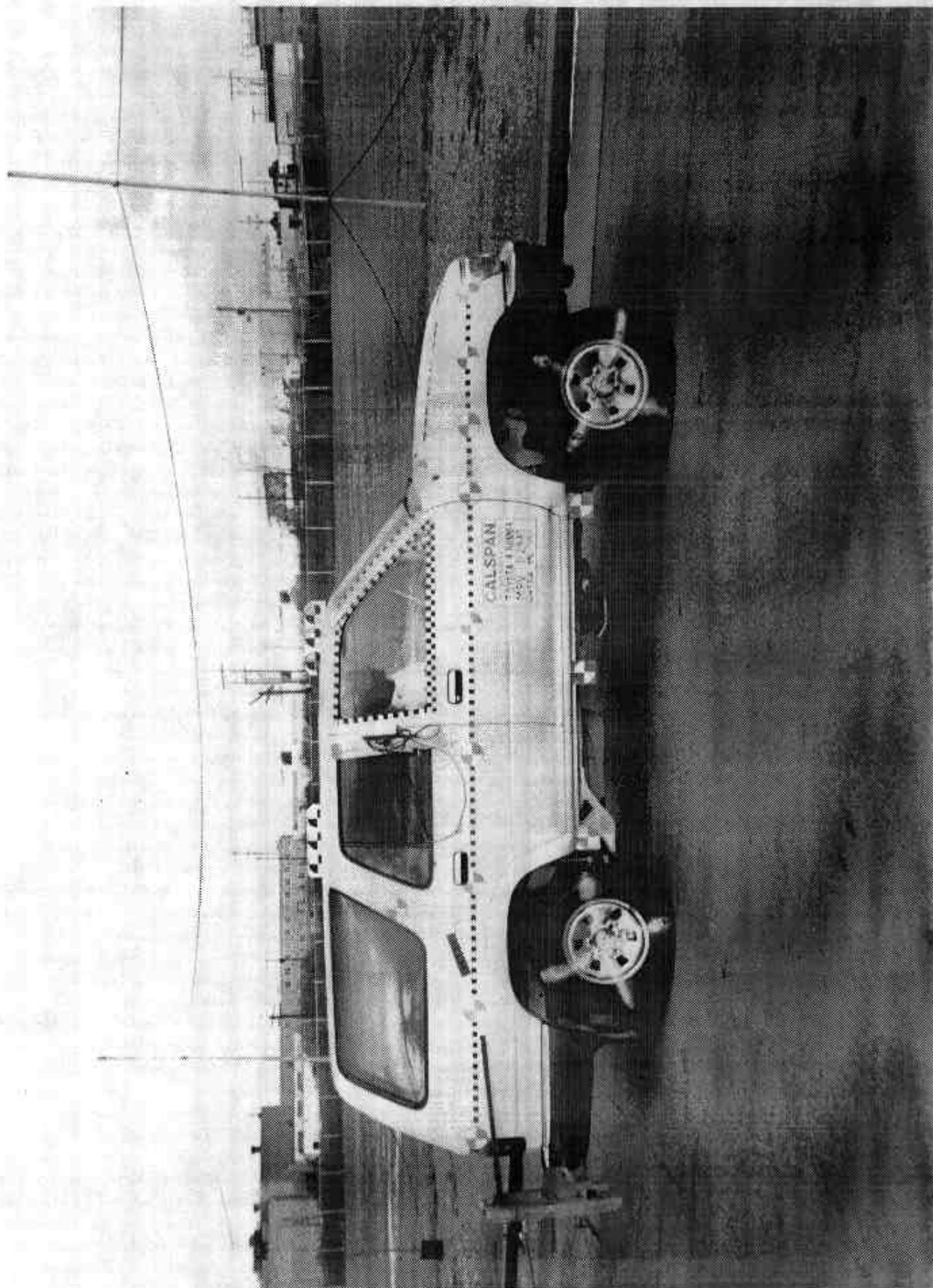


Figure A-6 PRE-TEST RIGHT SIDE VIEW

A-7

7776-2

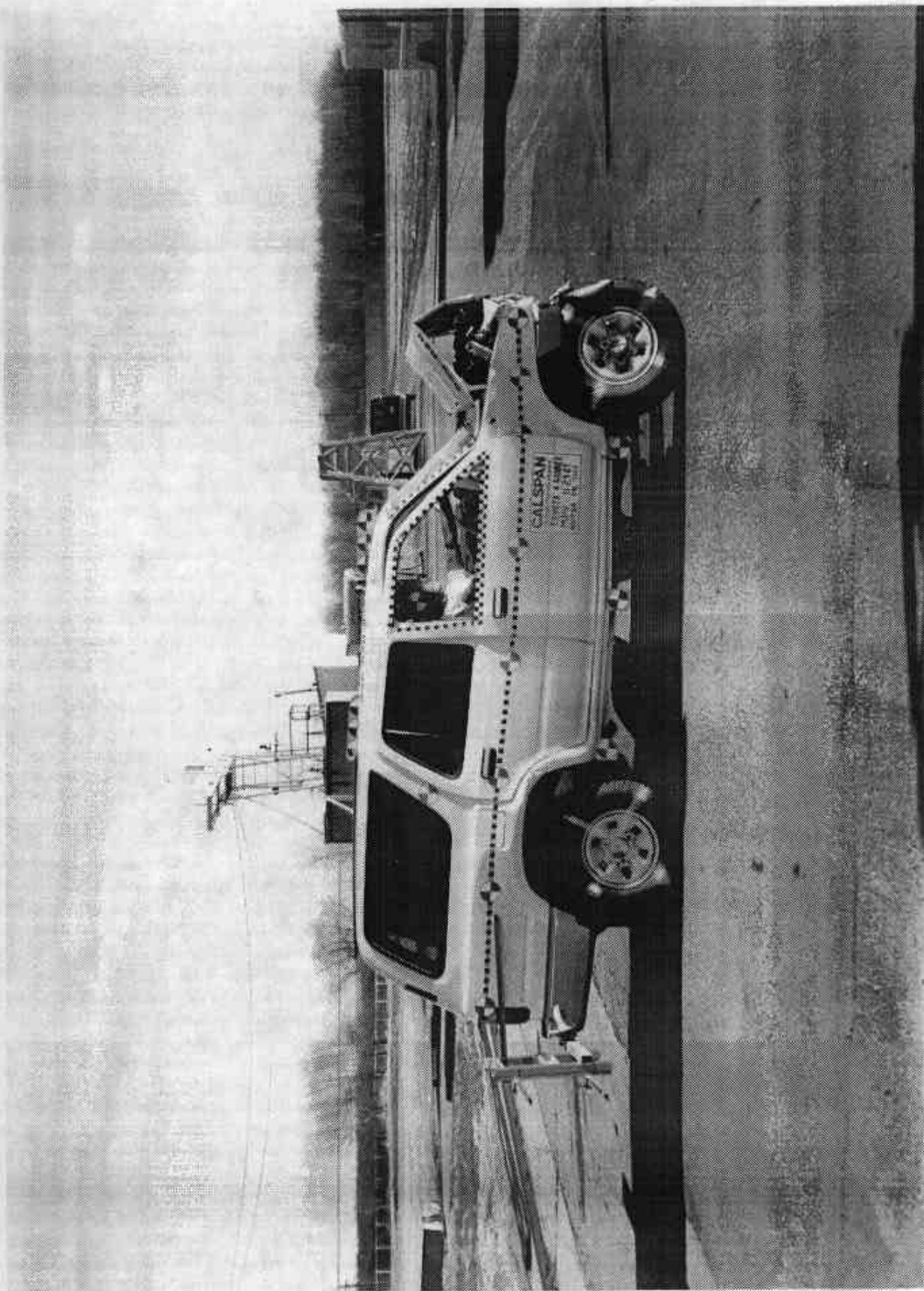


Figure A-7 POST-TEST RIGHT SIDE VIEW

A-8

7776-2



Figure A-8 PRE-TEST RIGHT FRONT THREE-QUARTER VIEW

A-9

7776-2

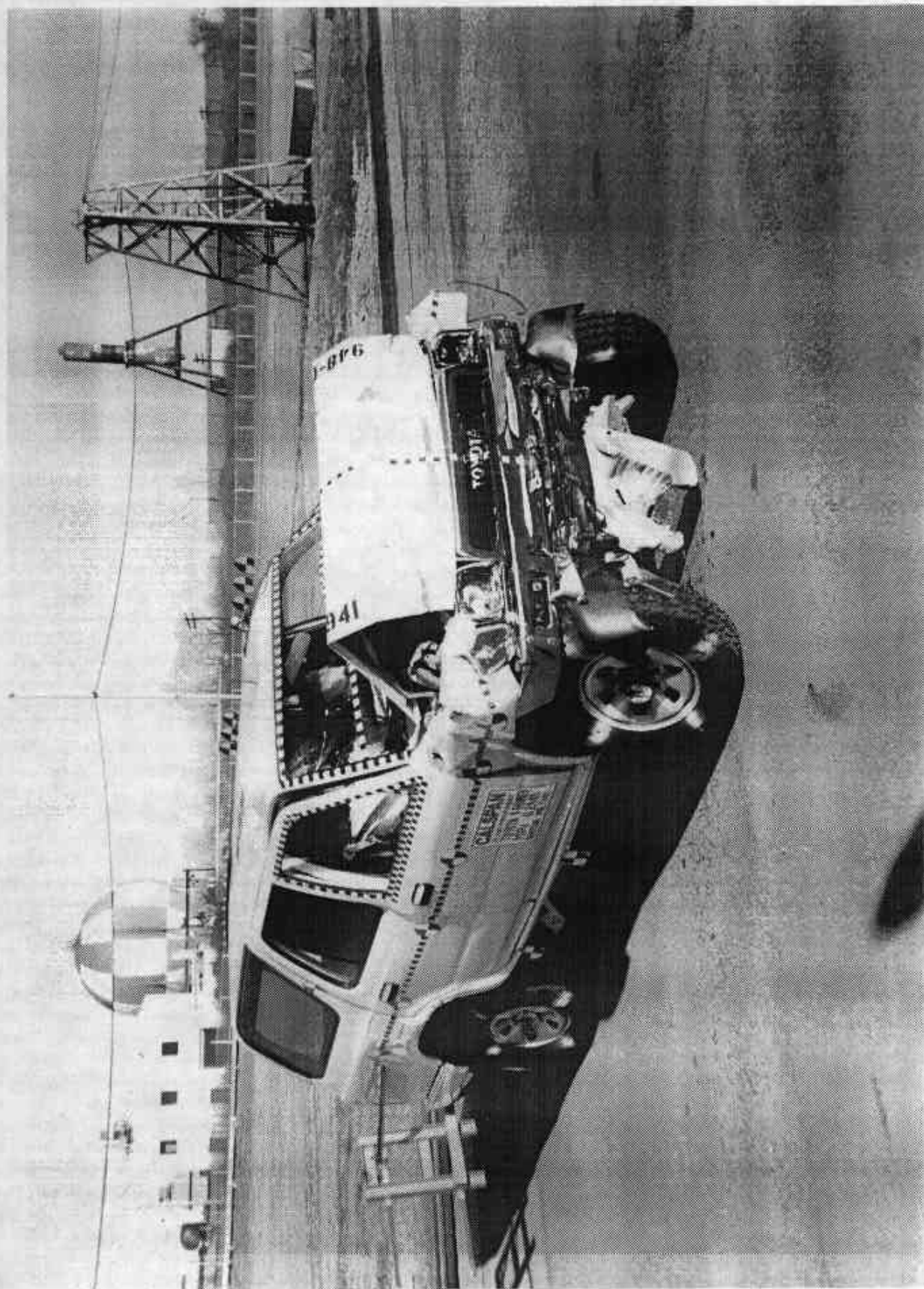


Figure A-9 POST-TEST RIGHT FRONT THREE-QUARTER VIEW

A-10

7776-2



Figure A-10 PRE-TEST LEFT REAR THREE-QUARTER VIEW

A-11

7776-2



Figure A-11 POST-TEST LEFT REAR THREE-QUARTER VIEW

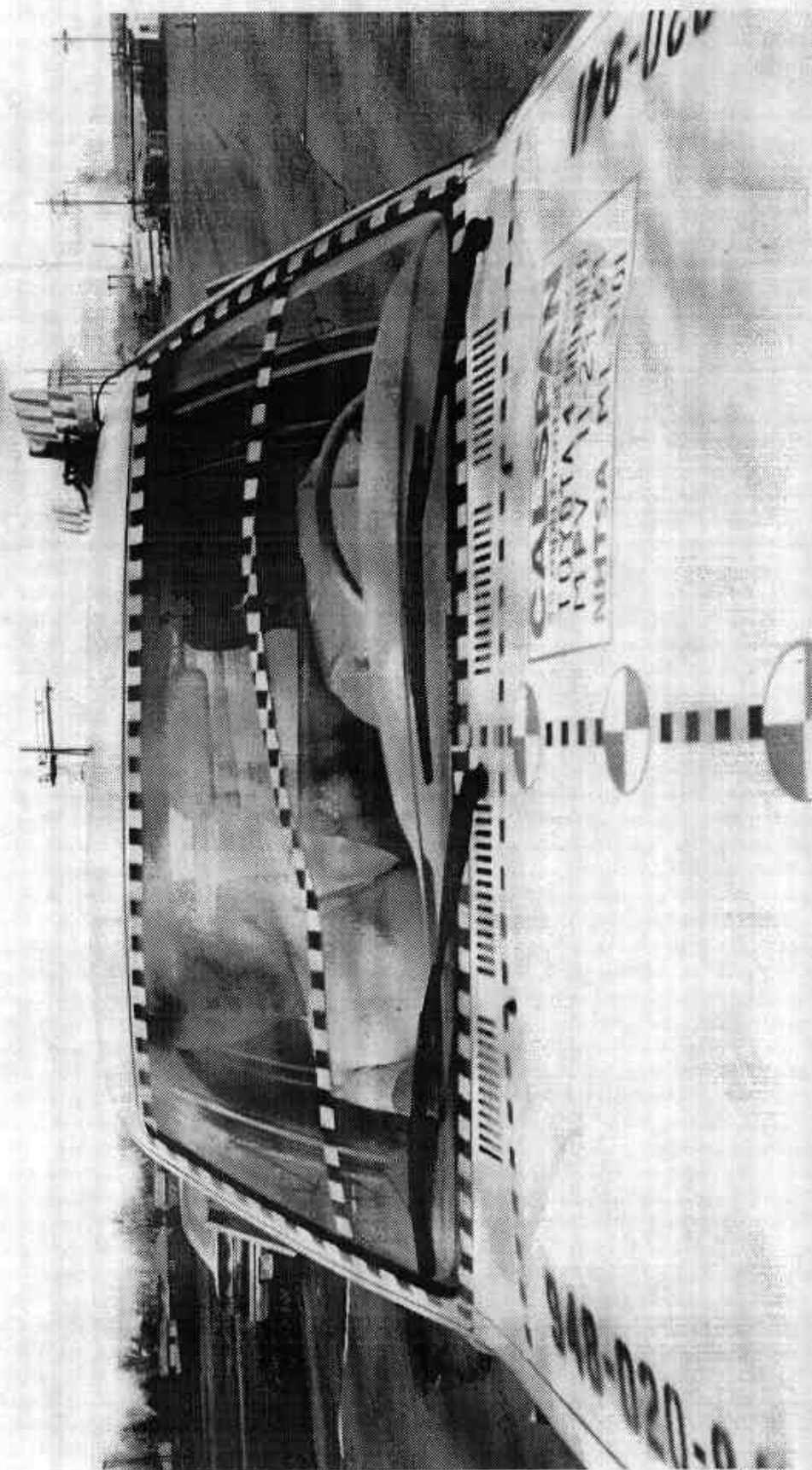


Figure A-12 PRE-TEST WINDSHIELD VIEW

A-13

7776-2

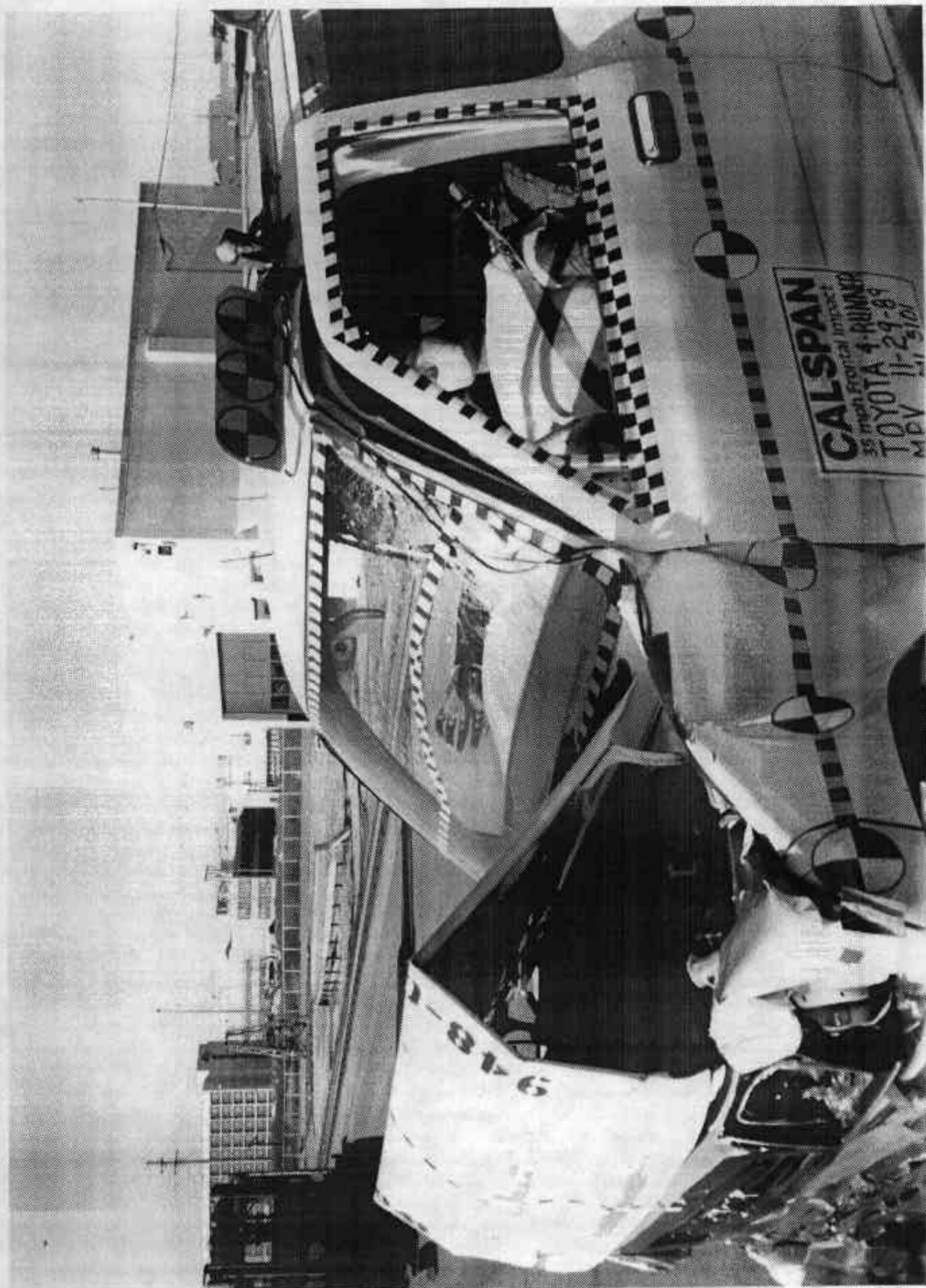


Figure A-13 POST-TEST WINDSHIELD VIEW

A-14

7776-2

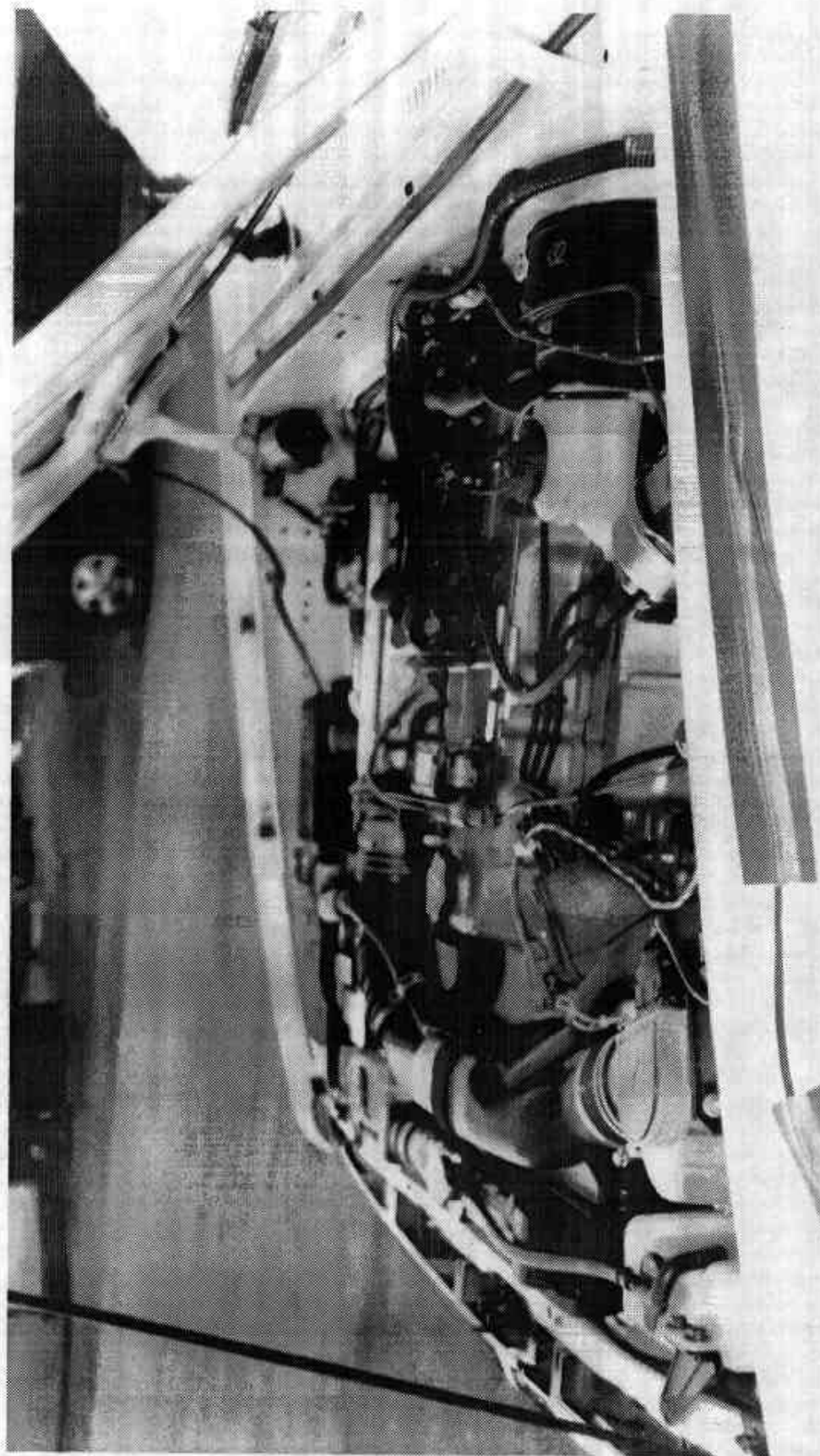


Figure A-14 PRE-TEST ENGINE COMPARTMENT VIEW

A-15

7776-2

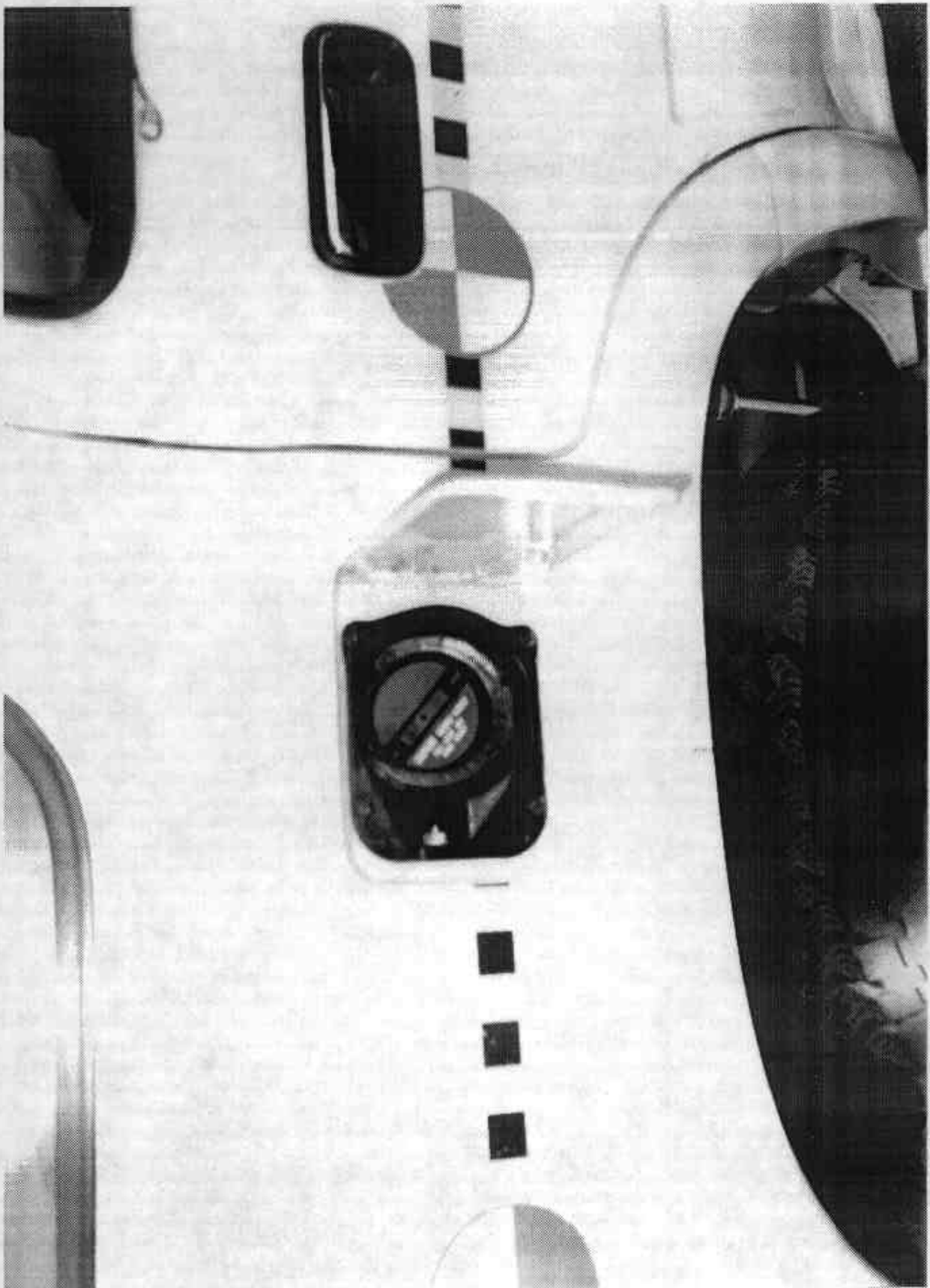


Figure A-15 PRE-TEST FUEL CAP VIEW

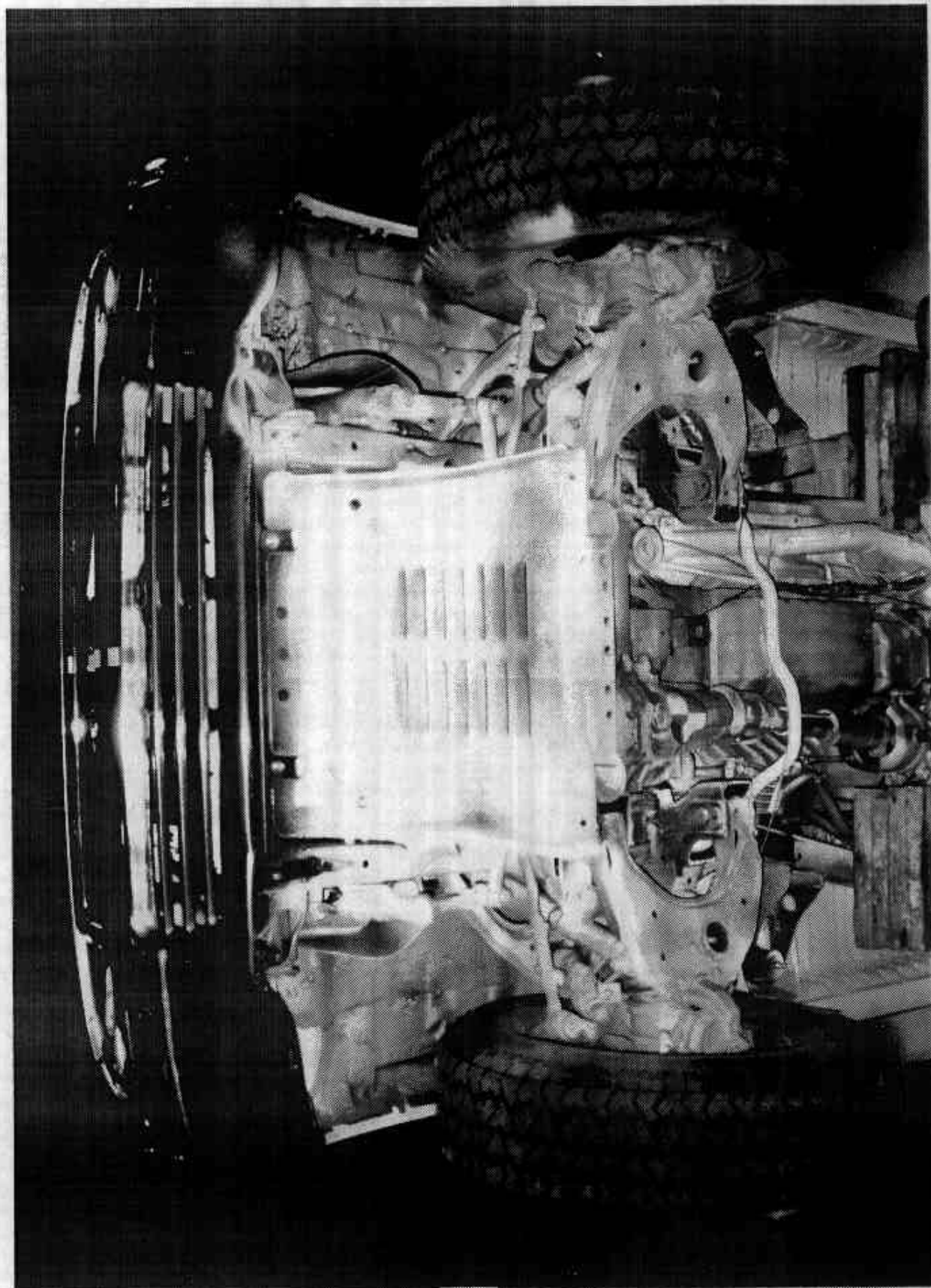


Figure A-16 PRE-TEST FRONT UNDERBODY VIEW

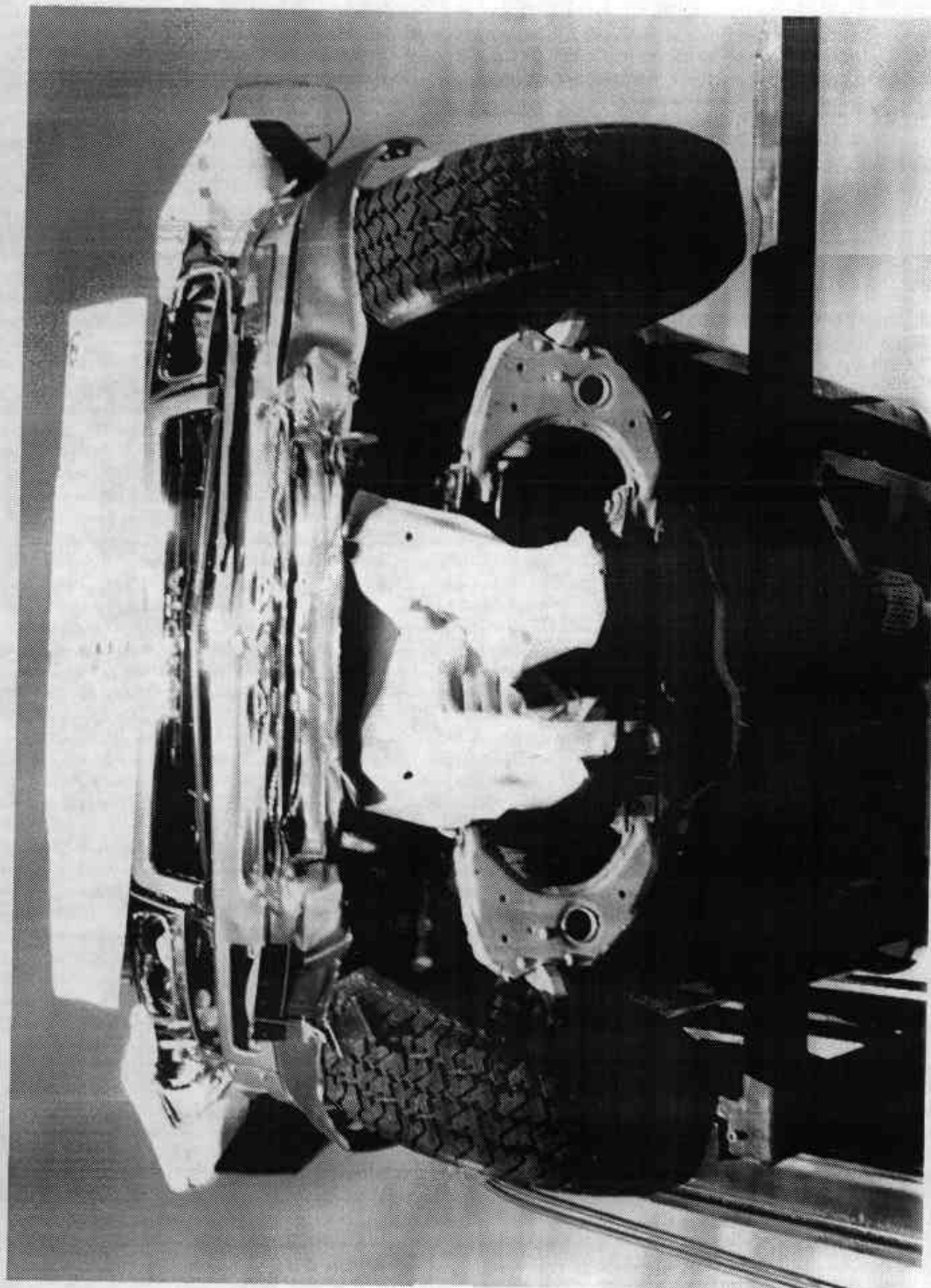


Figure A-17 POST-TEST FRONT UNDERBODY VIEW

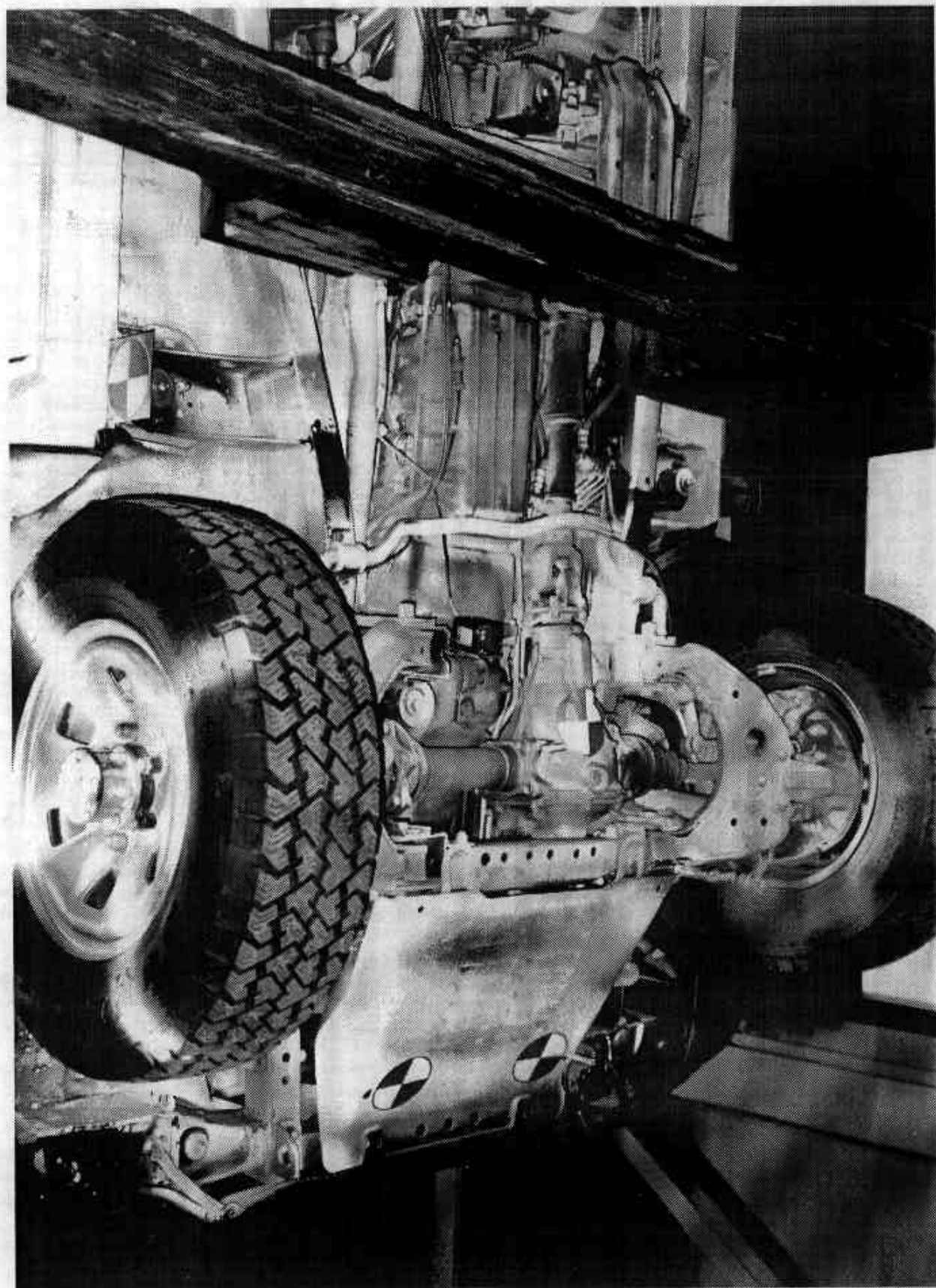


Figure A-18 PRE-TEST FRONT SIDE UNDERBODY VIEW

A-19

7776-2

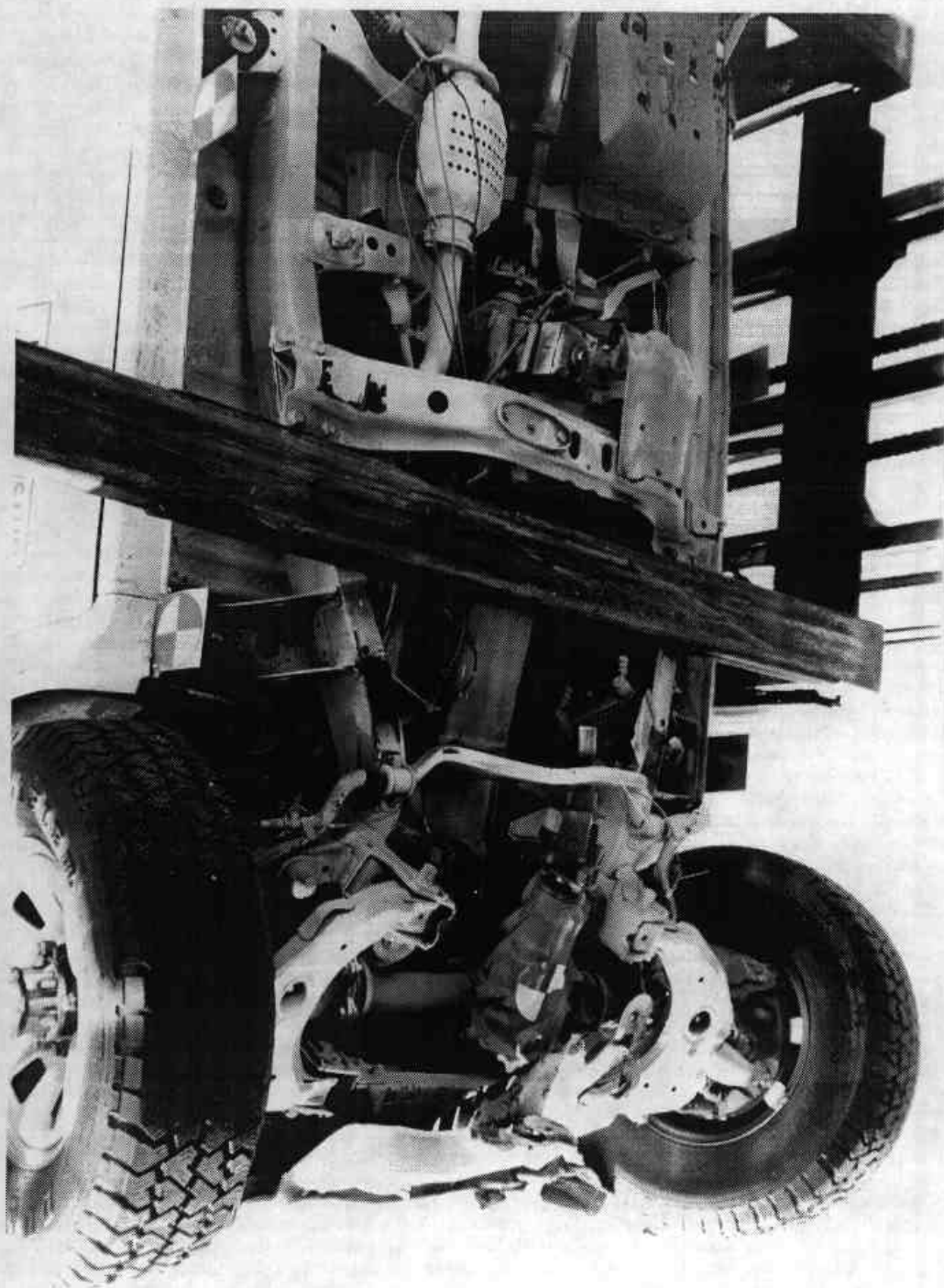


Figure A-19 POST-TEST FRONT SIDE UNDERBODY VIEW

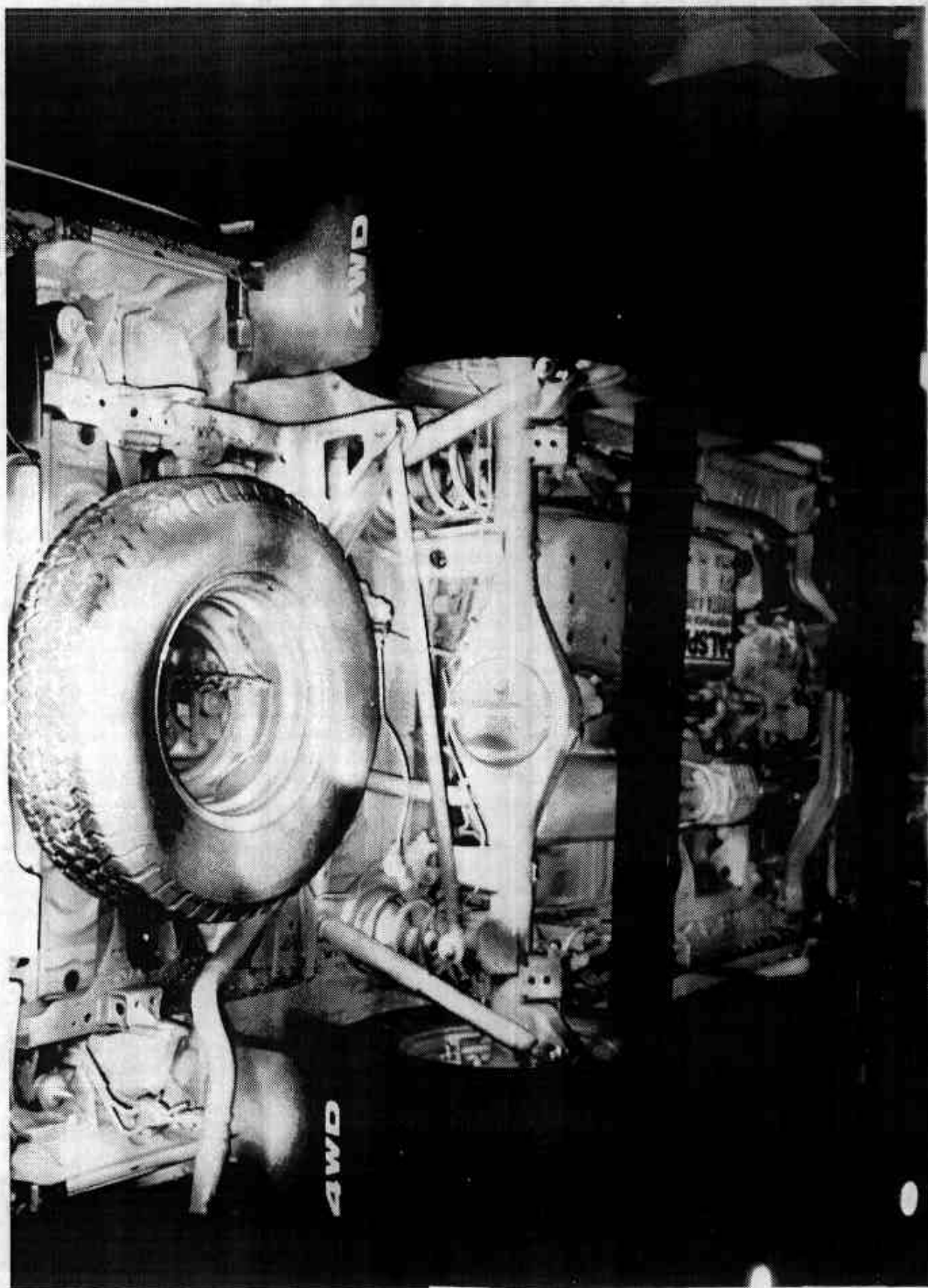


Figure A-20 PRE-TEST REAR UNDERBODY VIEW

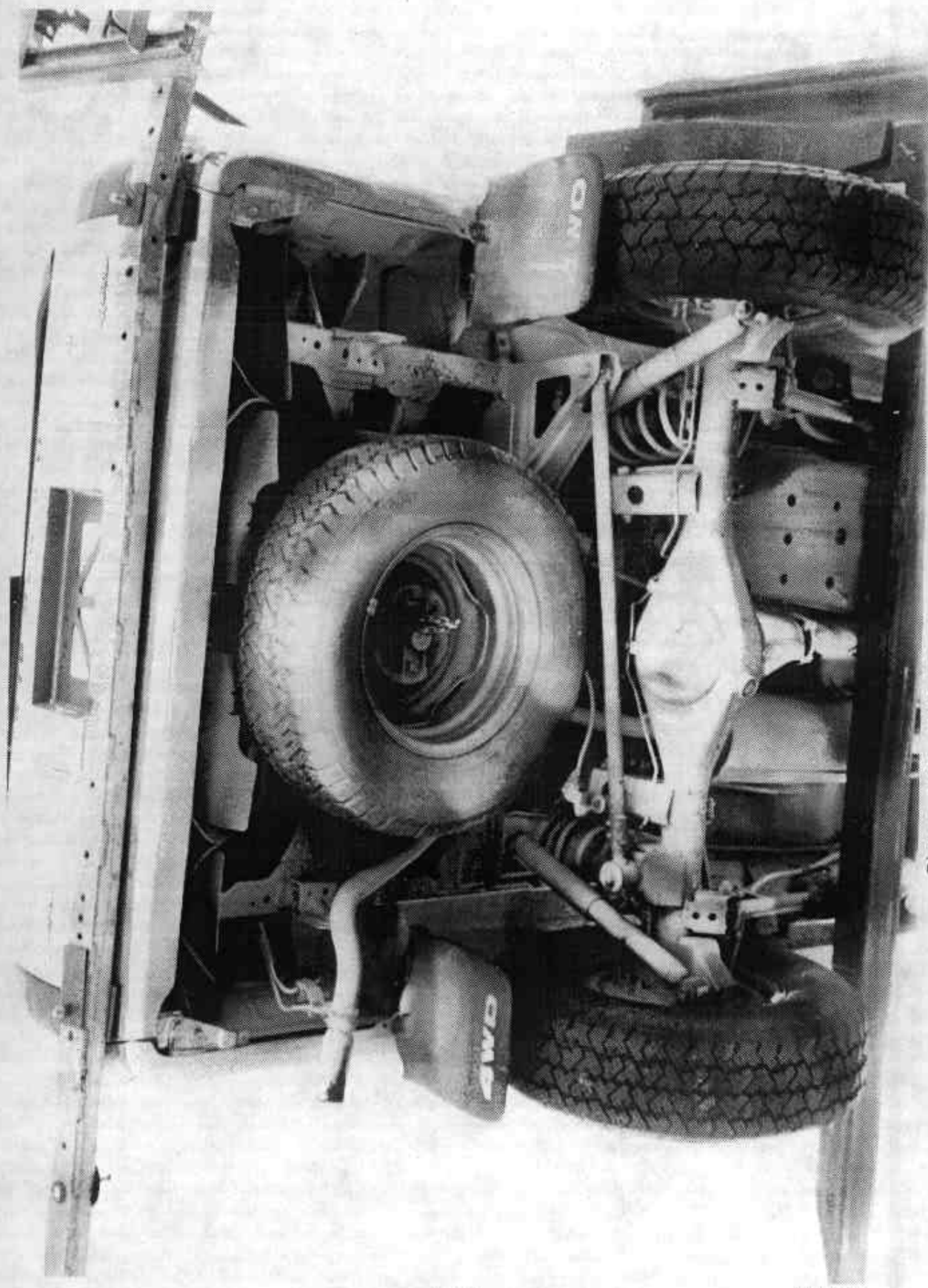


Figure A-21 POST-TEST REAR UNDERBODY VIEW

A-22

7776-2

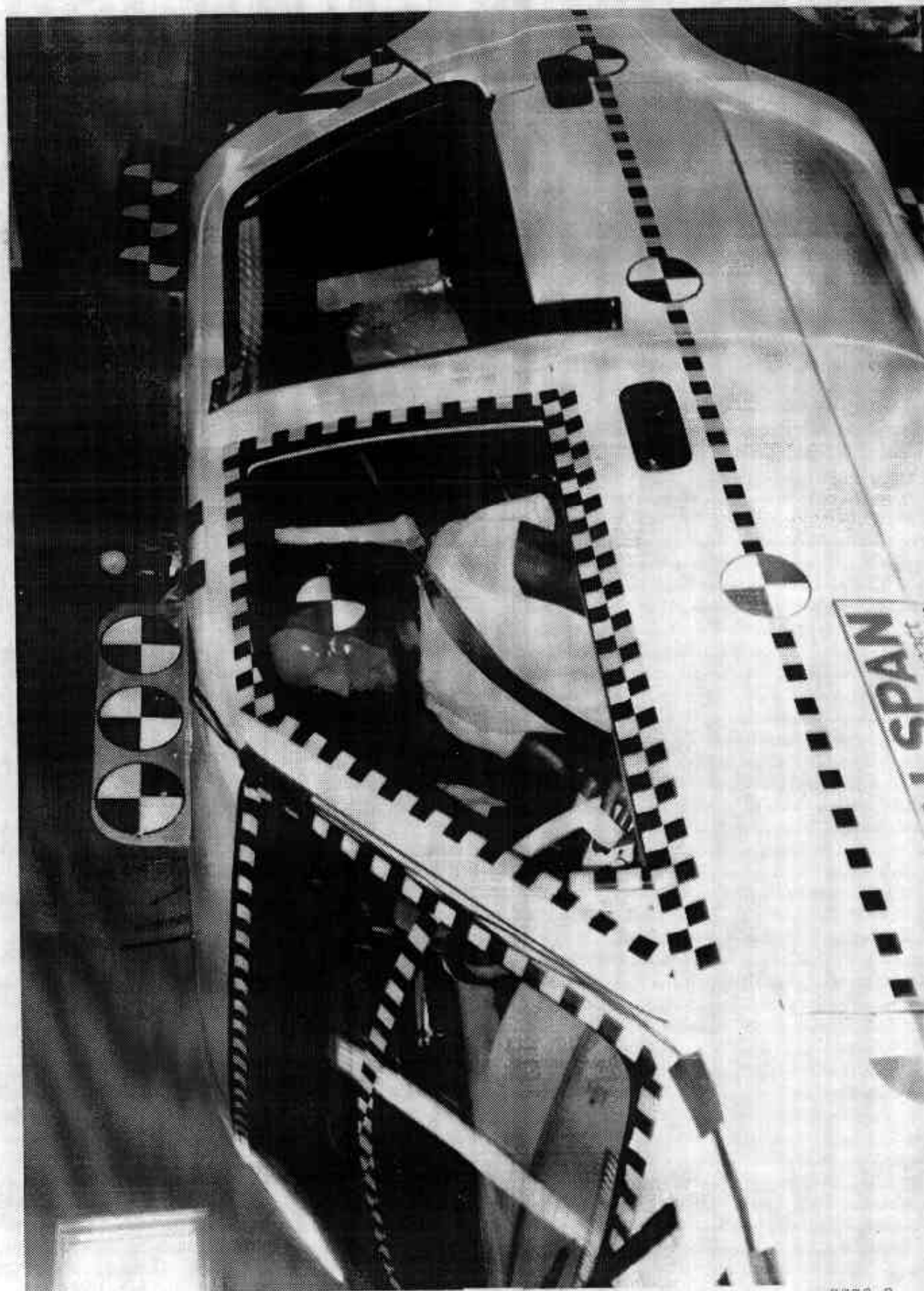


Figure A-22 PRE-TEST DRIVER POSITION VIEW

A-23

7776-2

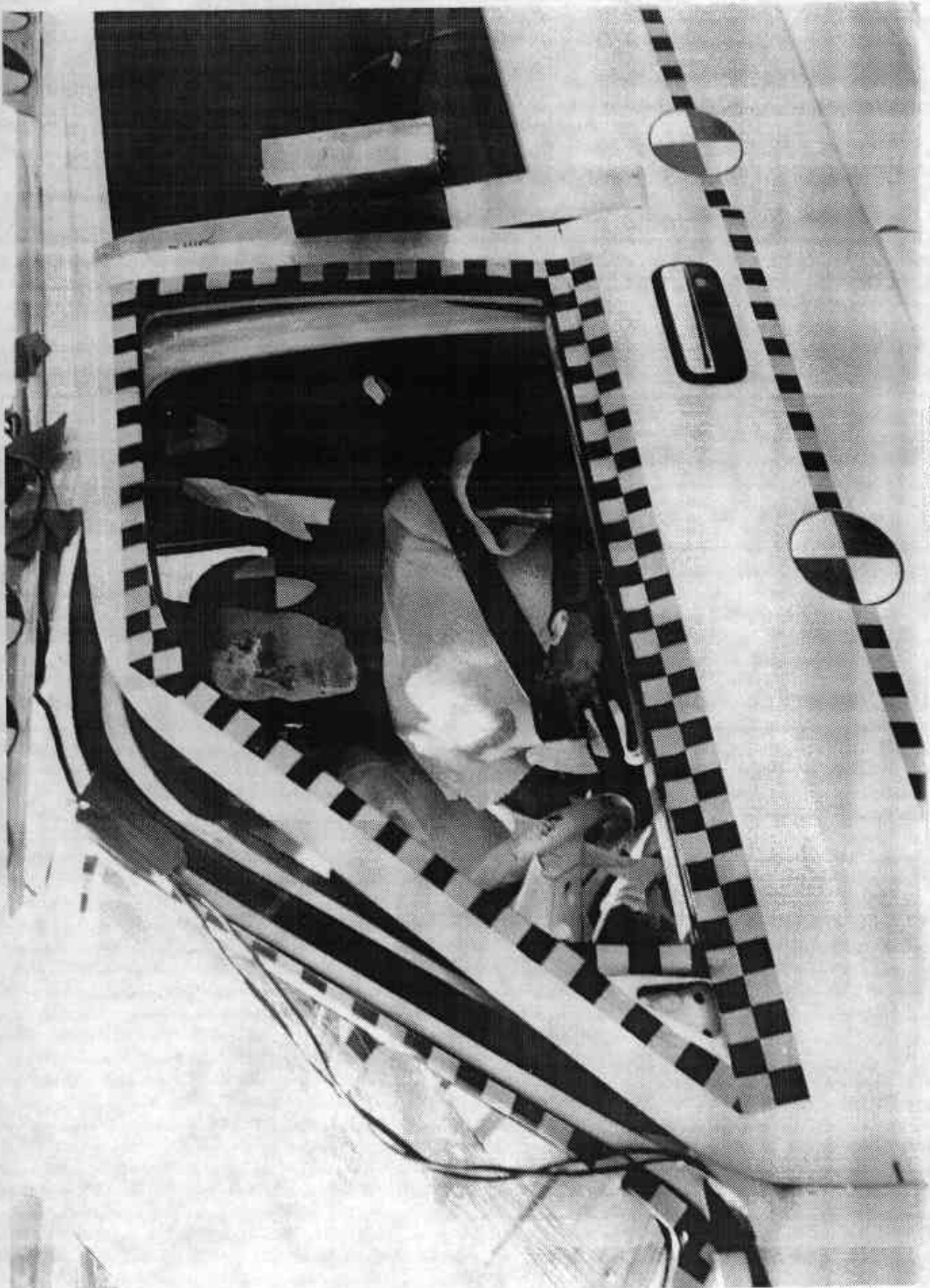


Figure A-23 POST-TEST DRIVER POSITION VIEW

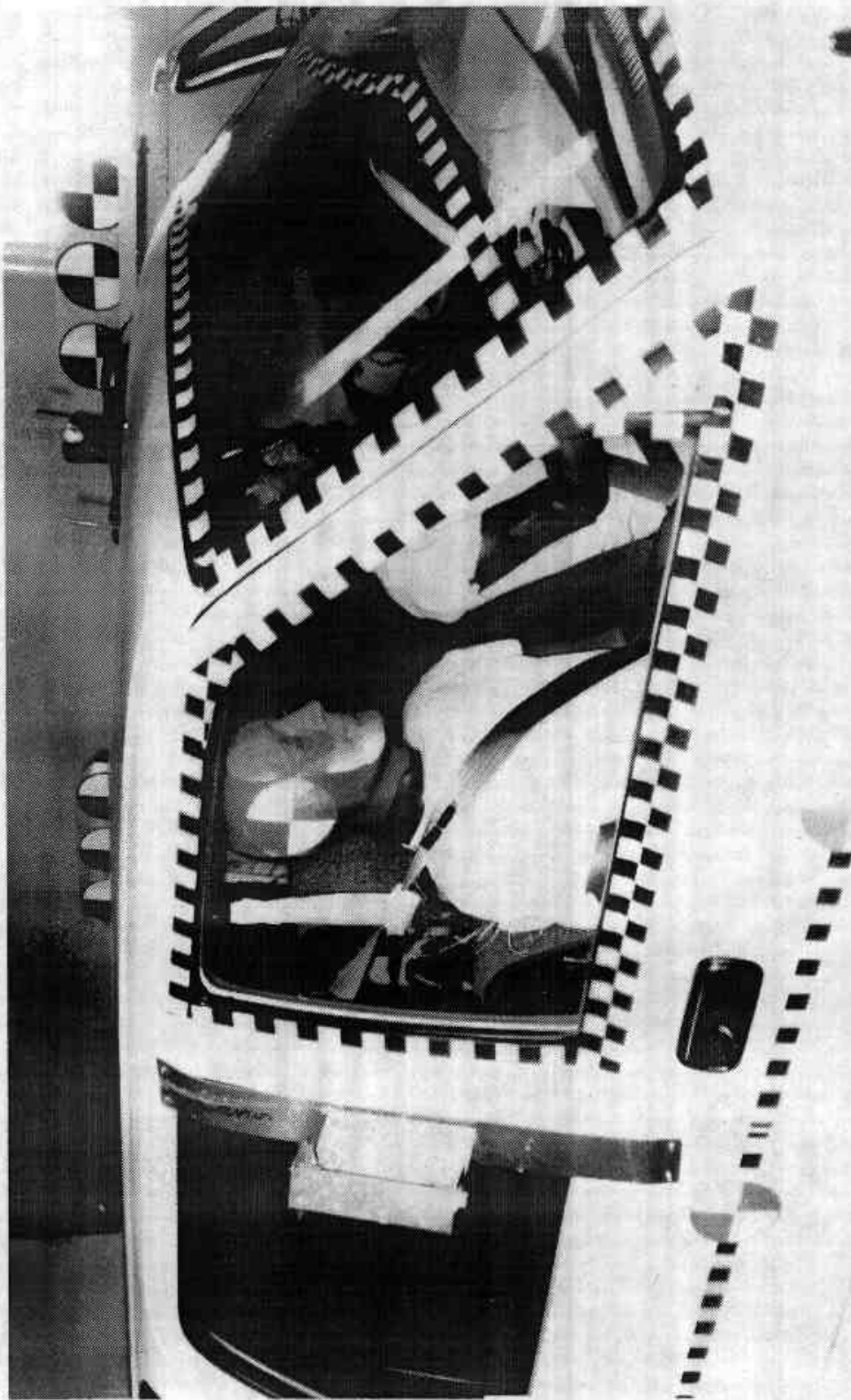


Figure A-24 PRE-TEST PASSENGER POSITION VIEW

A-25

7776-2

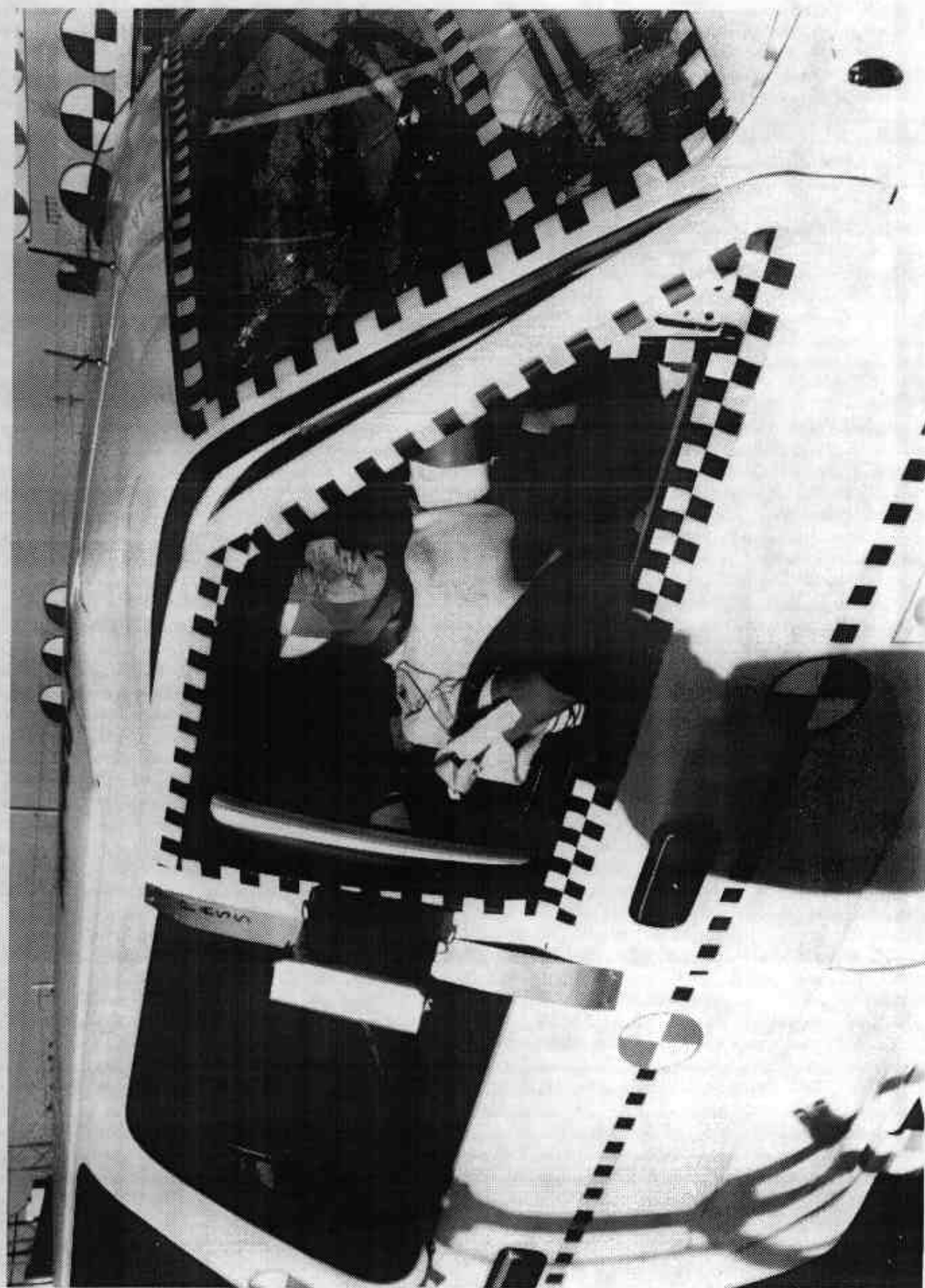


Figure A-25 POST-TEST PASSENGER POSITION VIEW

A-26

7776-2

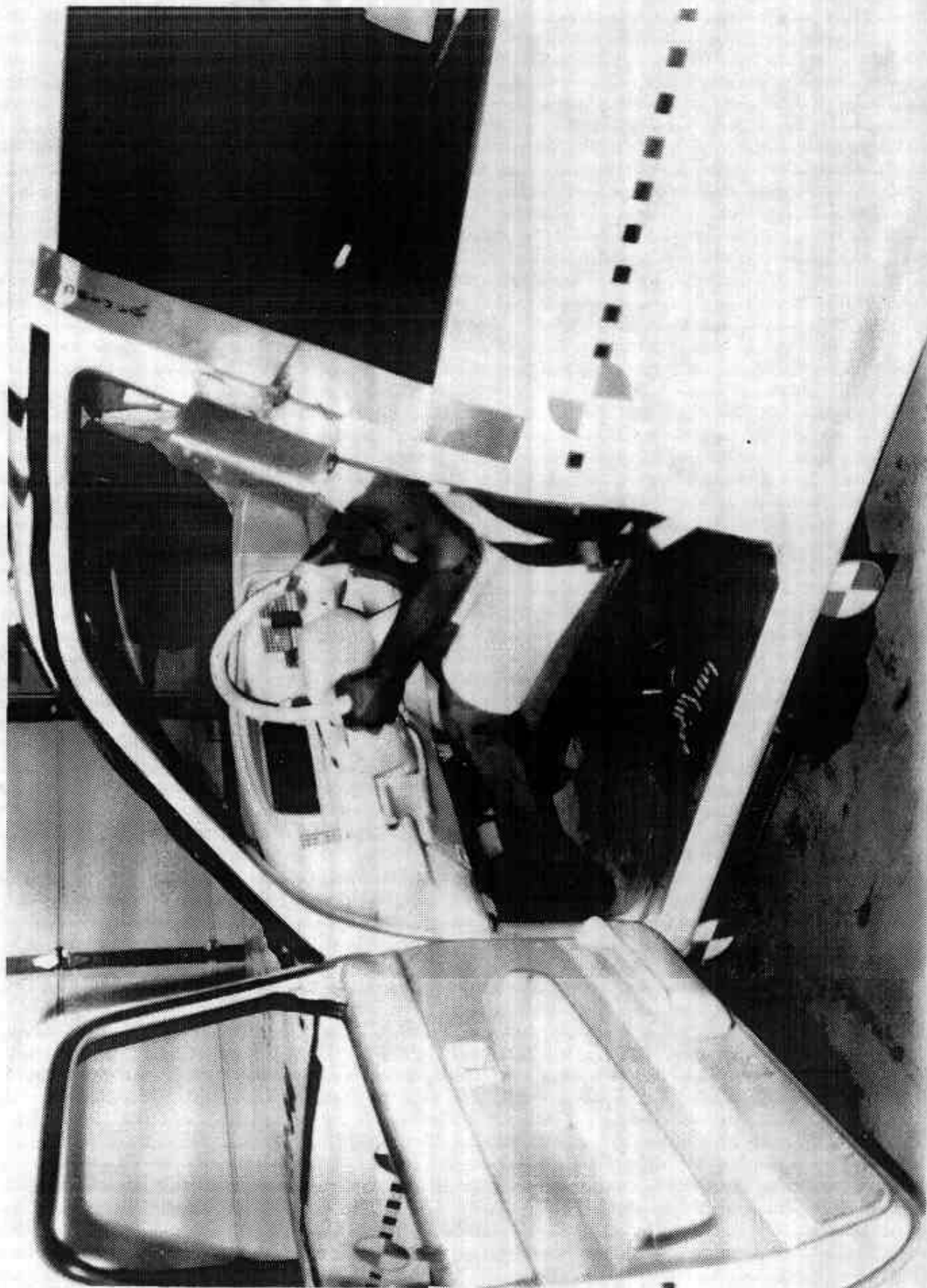


Figure A-26 PRE-TEST DRIVER AND INTERIOR VIEW

A-27

7776-2

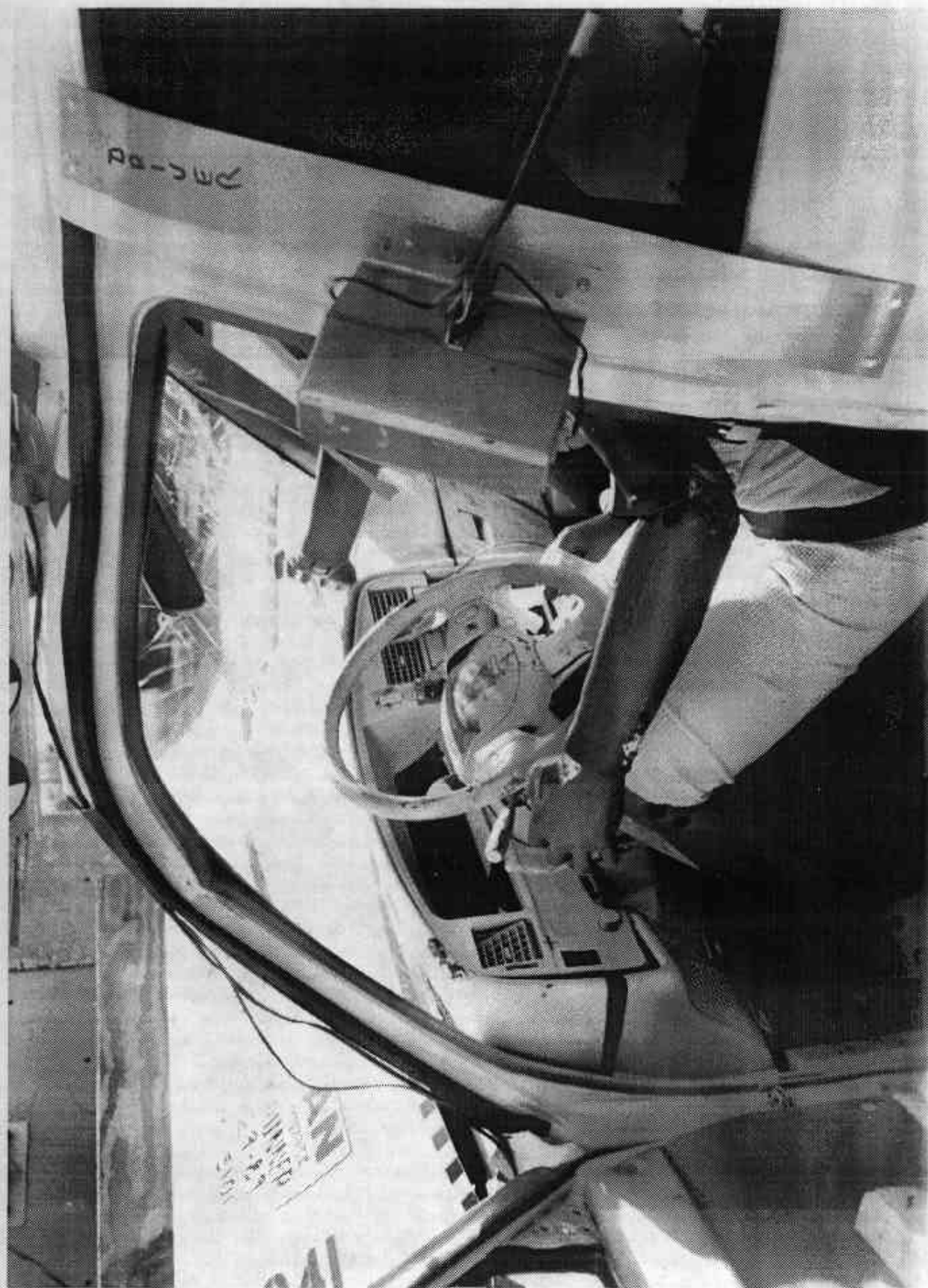


Figure A-27 POST-TEST DRIVER AND INTERIOR VIEW

A-28

7776-2

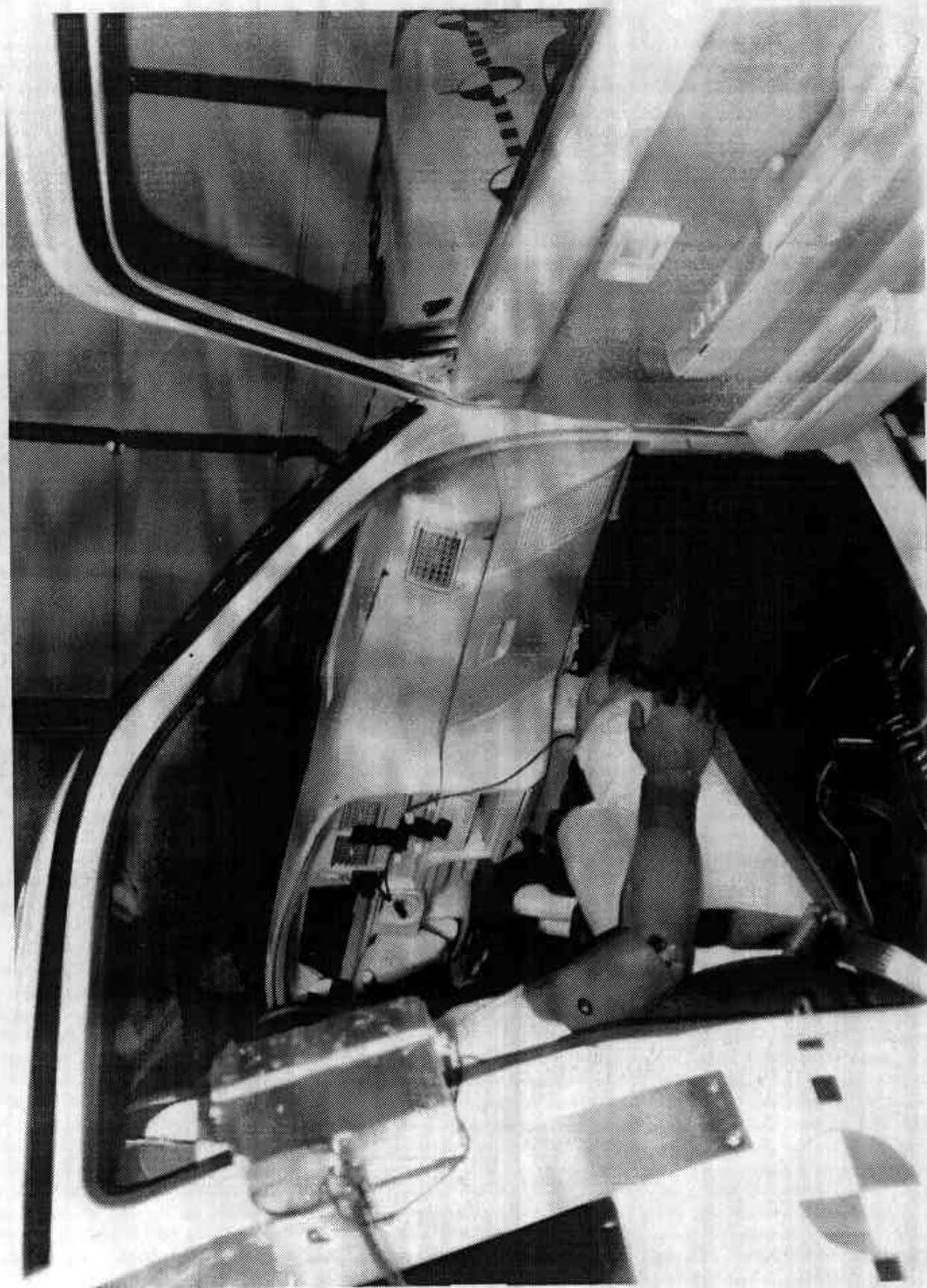


Figure A-28. PRE-TEST PASSENGER AND INTERIOR VIEW

A-29

7776-2



Figure A-29 POST-TEST PASSENGER AND INTERIOR VIEW

**Appendix B**

**VEHICLE, LOAD CELL BARRIER AND DUMMY RESPONSE DATA**

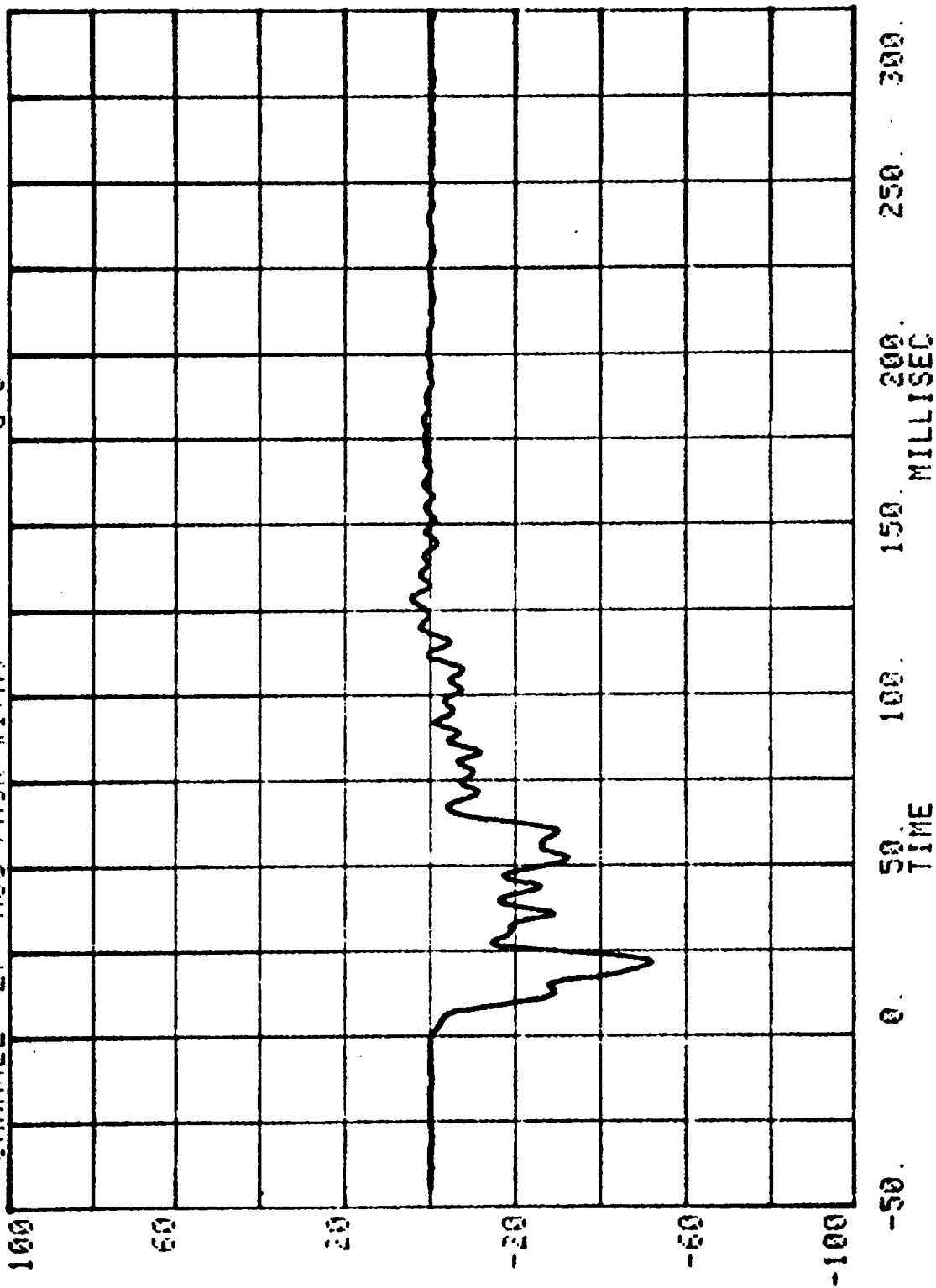
TEST NO. ML5101

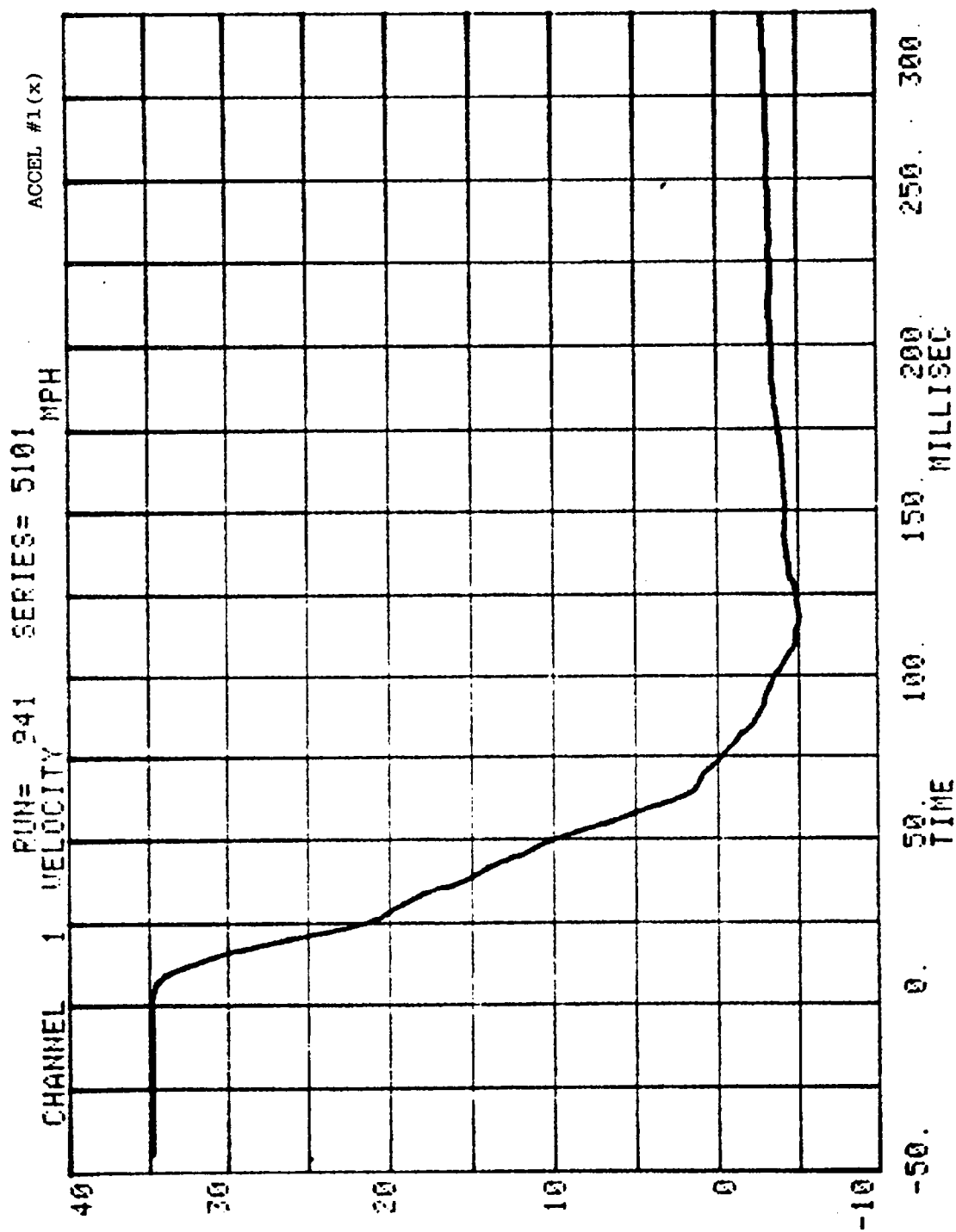
VEHICLE DATA

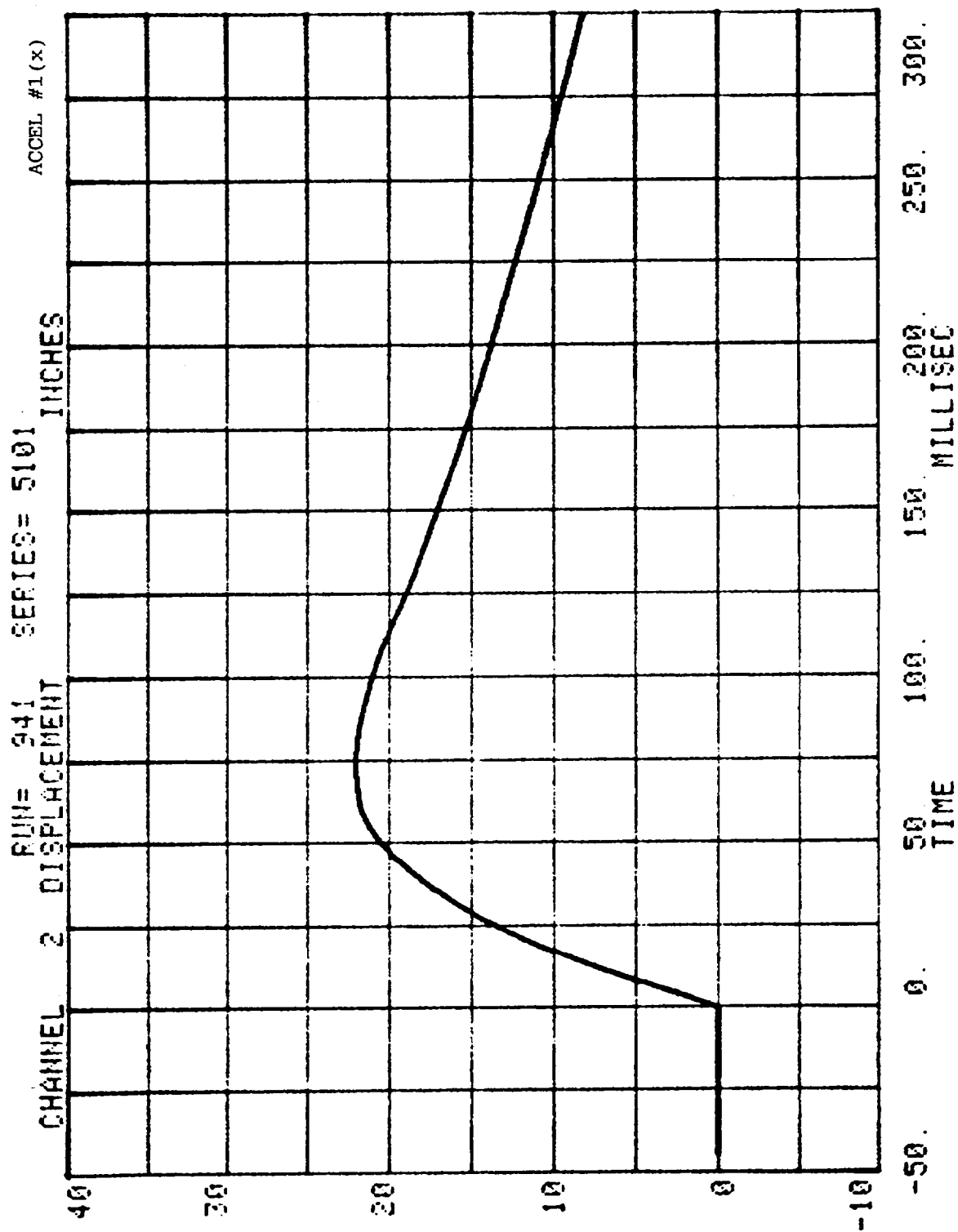
FILTER CHANNEL CLASS

60

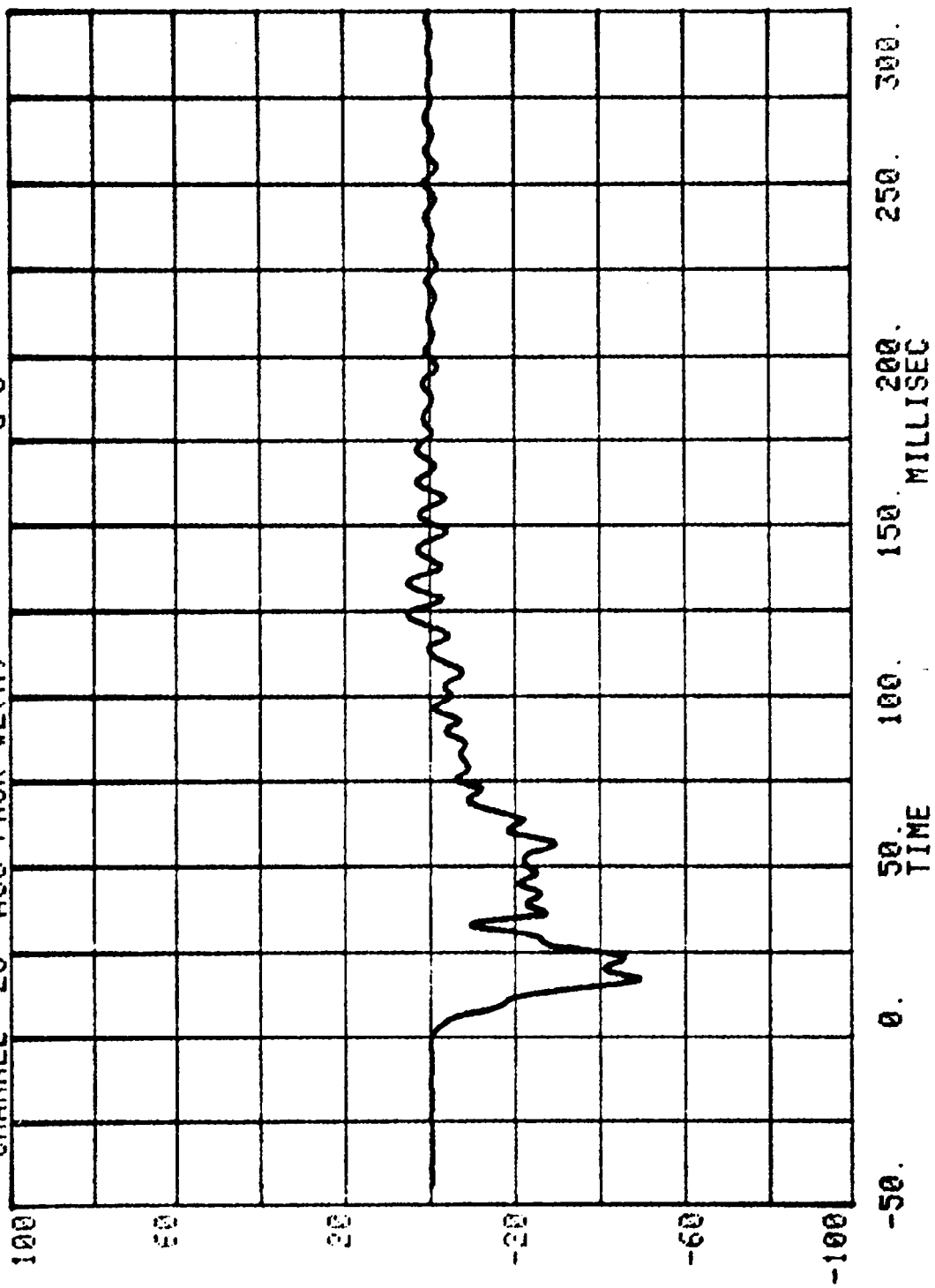
CHANNEL 27 ACC PACK #1(X) RUN= 941 SERIES= 5101 G'S

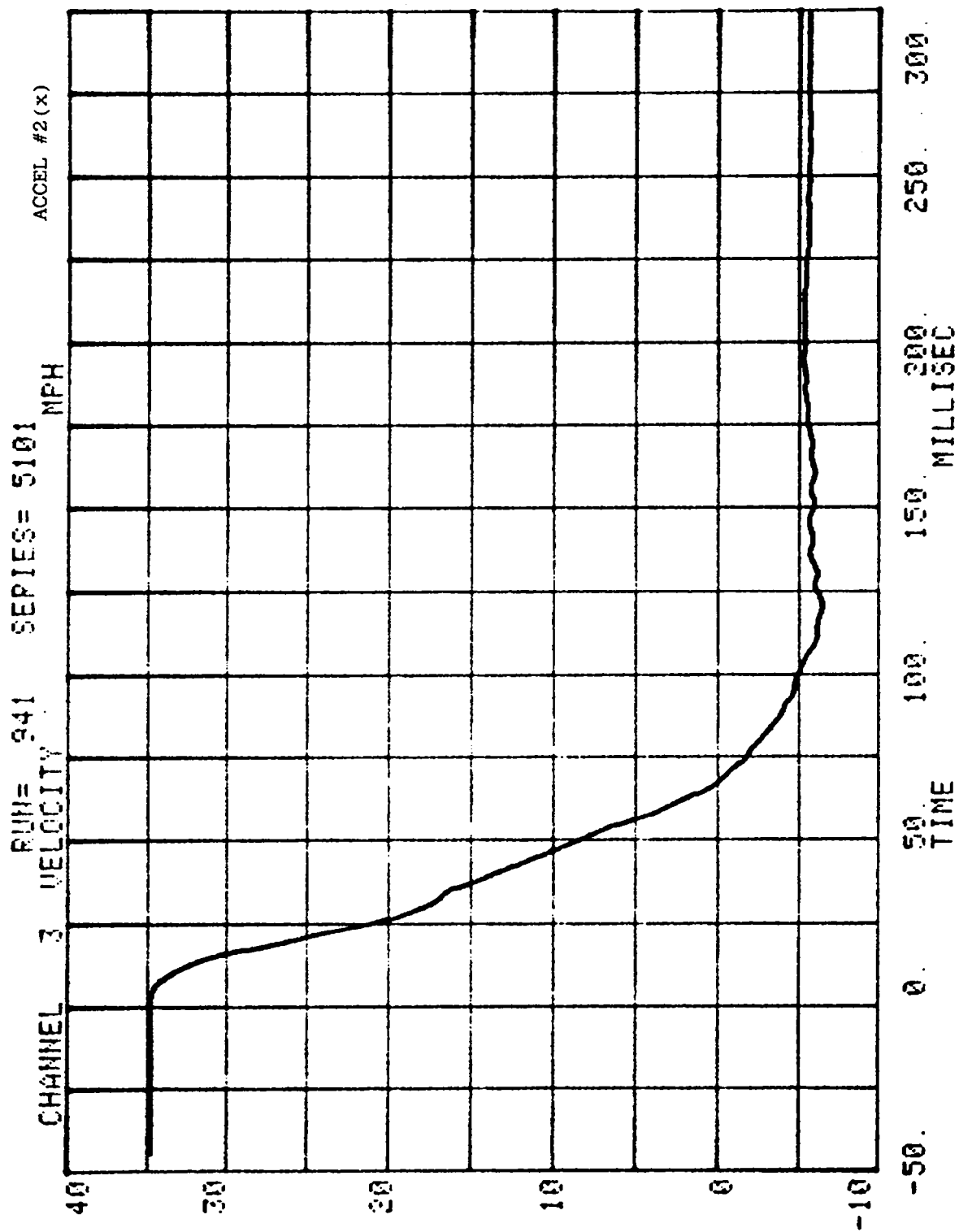


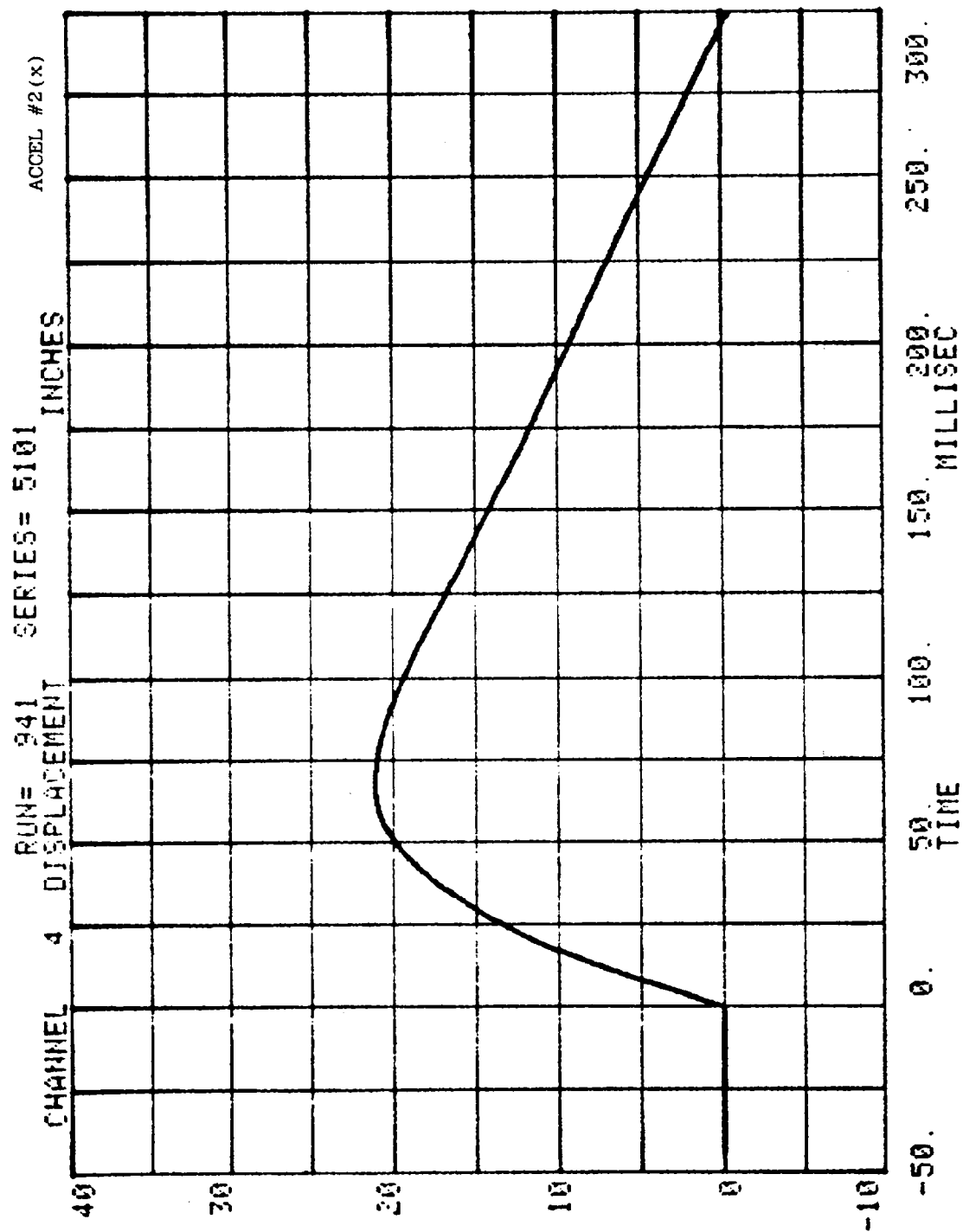


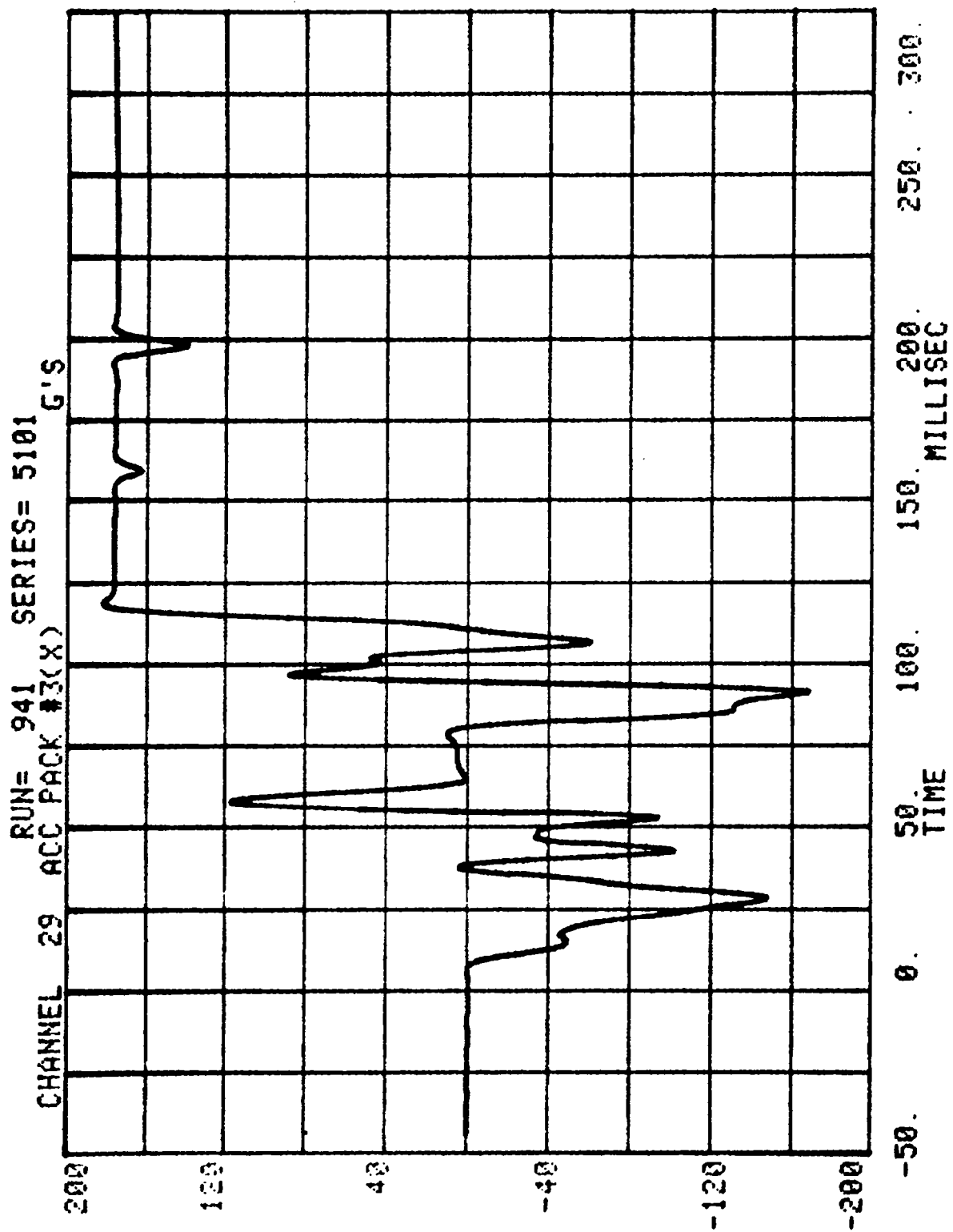


RUN= 941 SERIES= 5101 G'S  
CHANNEL 28 ACC PACK #2(X)

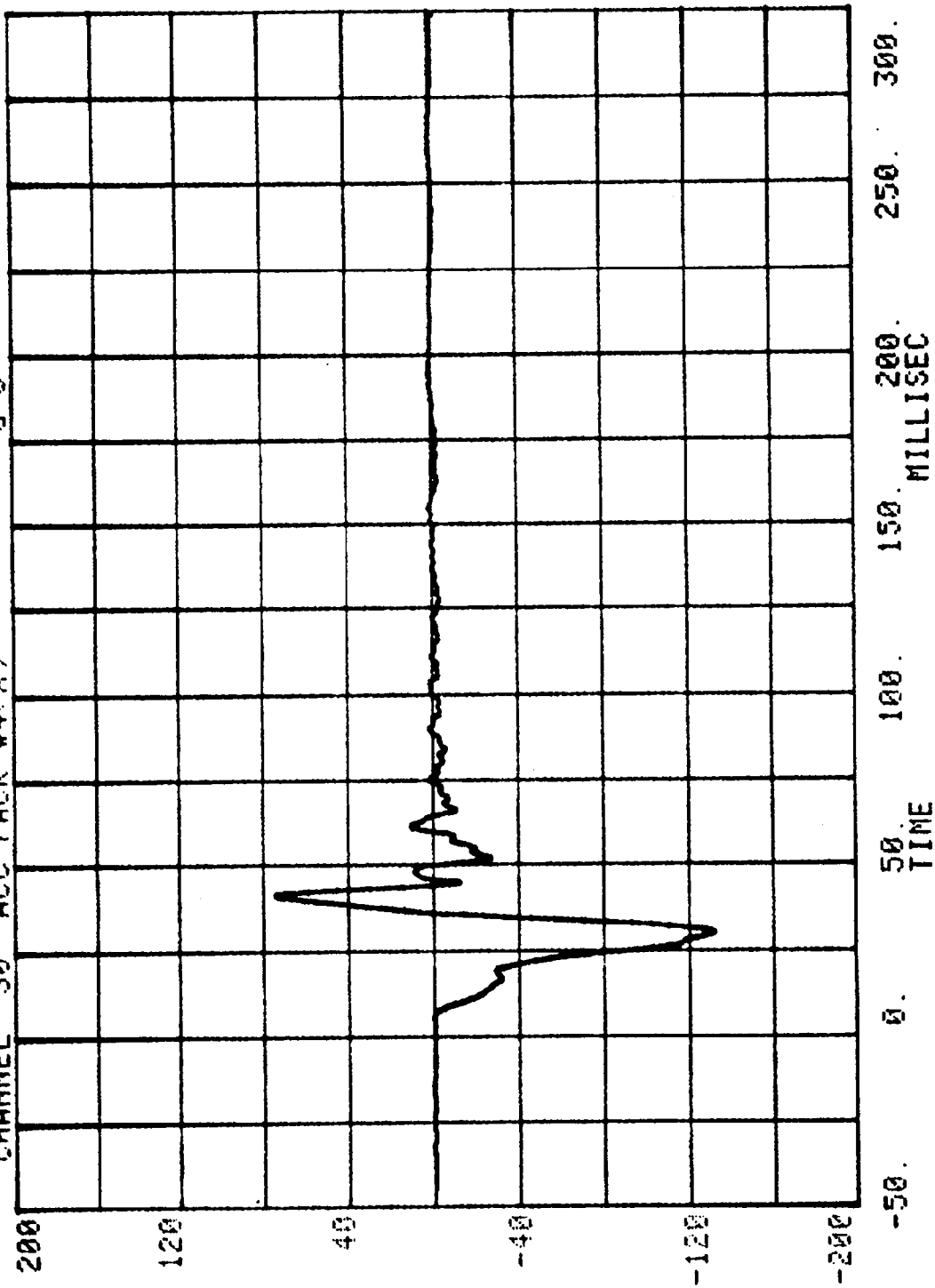


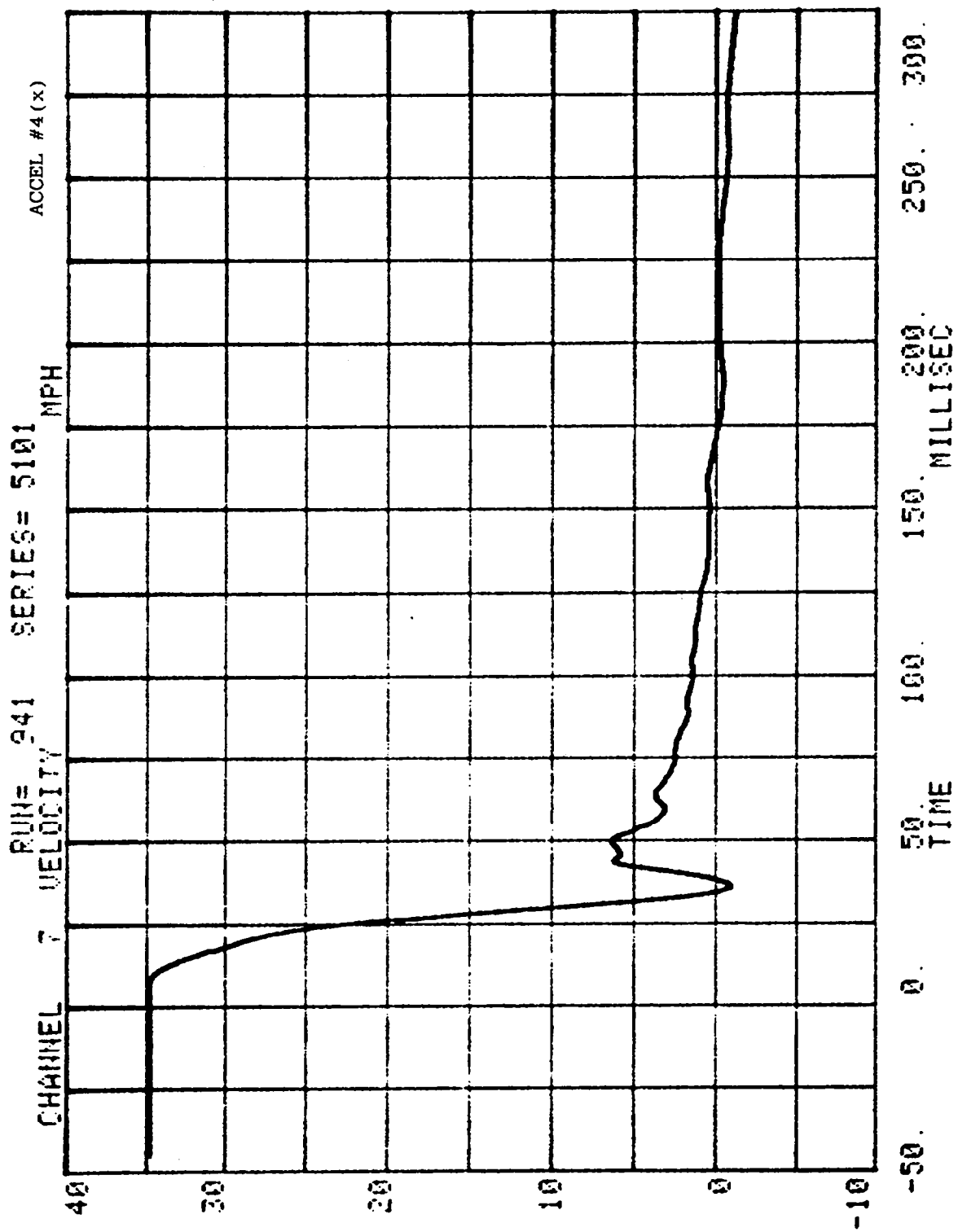


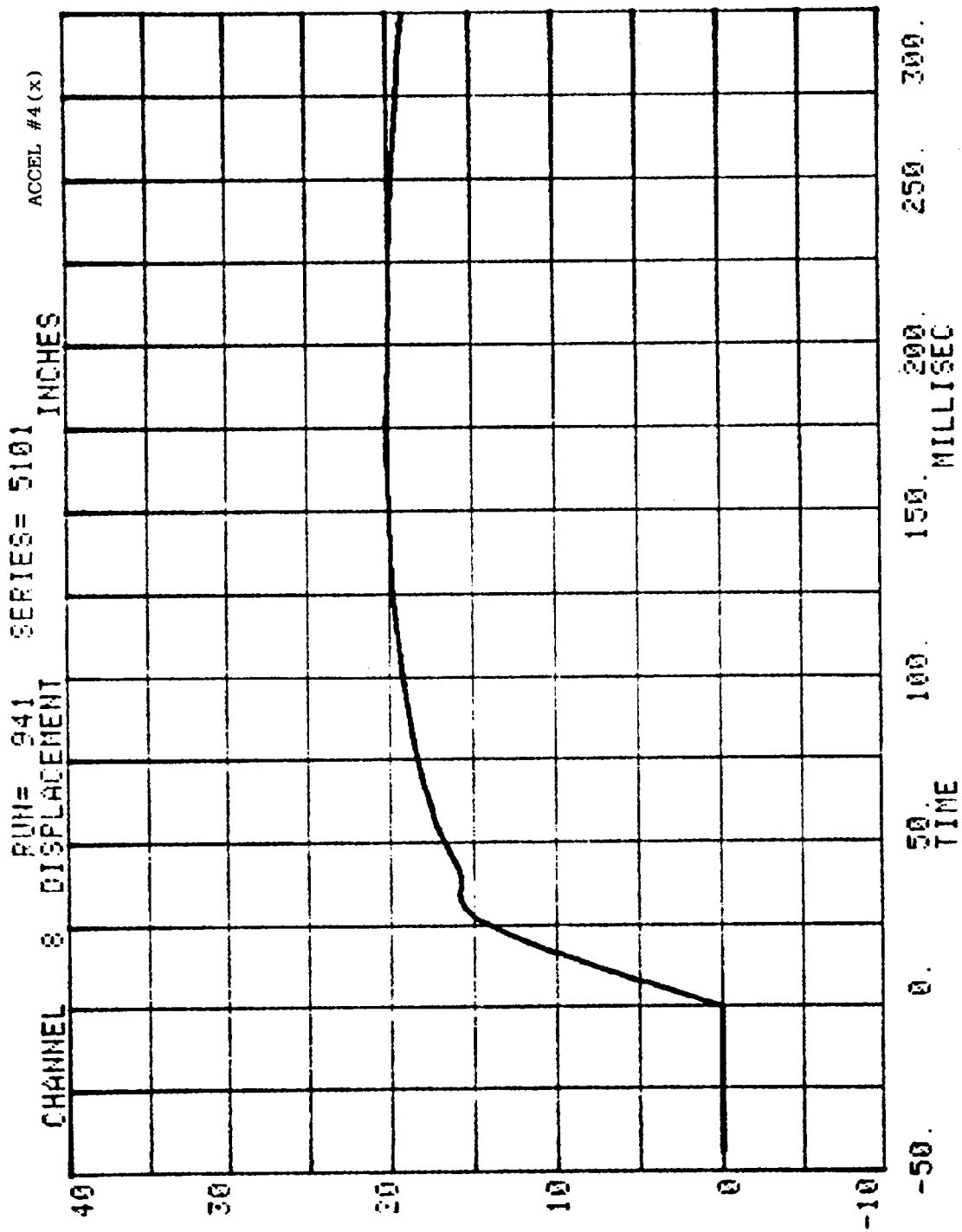




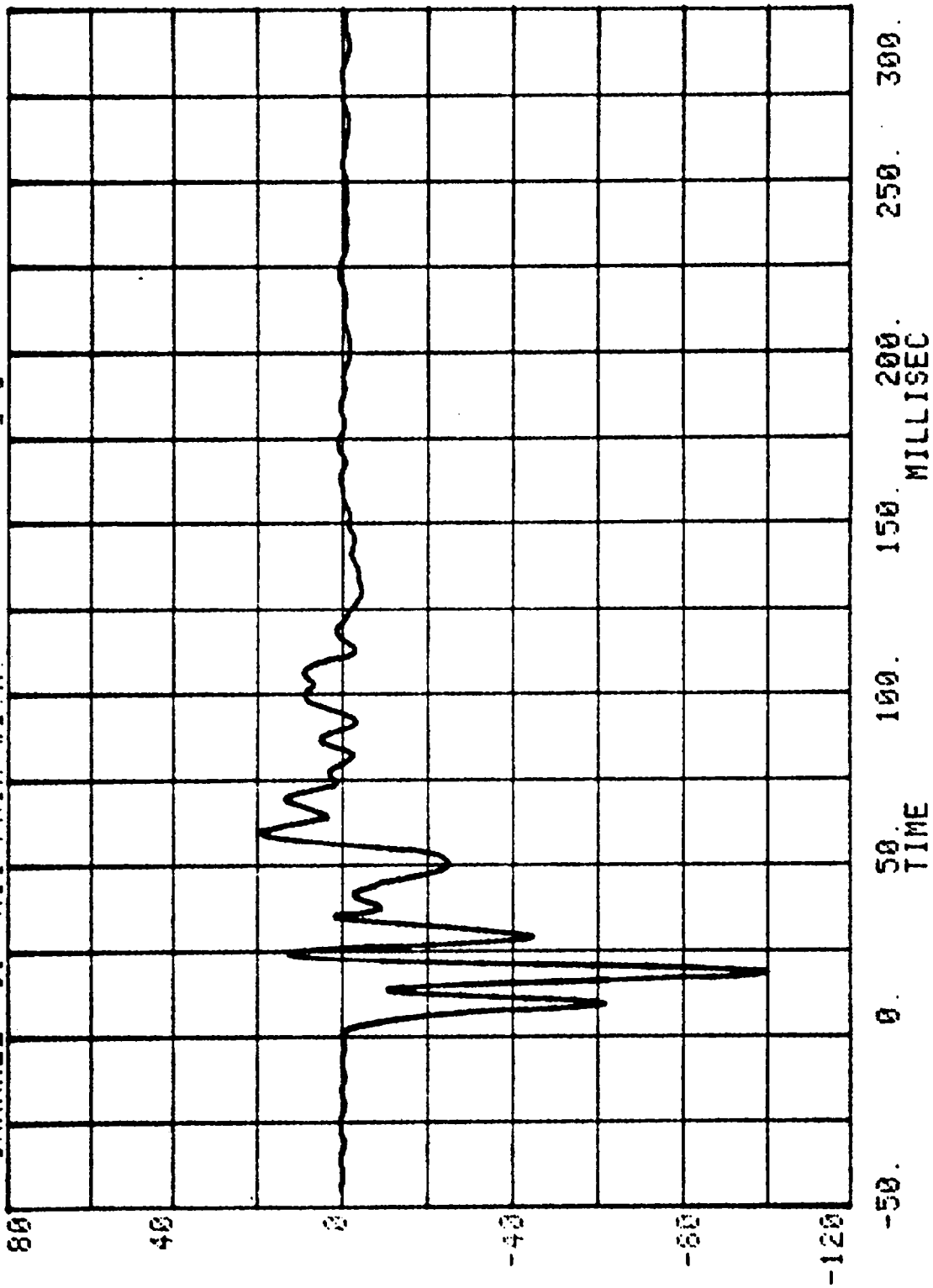
RUN= 941 SERIES= 5101 G'S  
CHANNEL 30 ACC PACK #4(X)

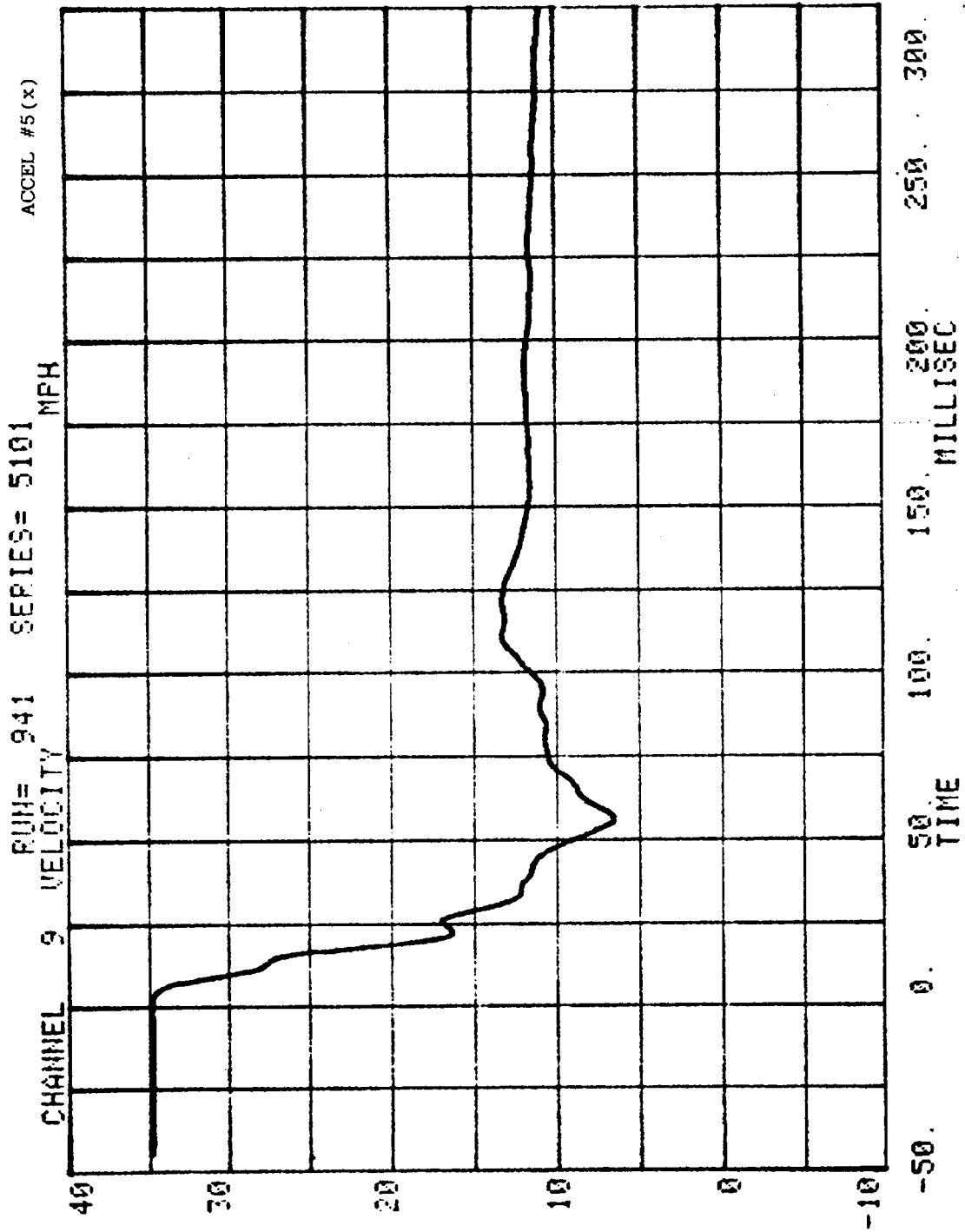






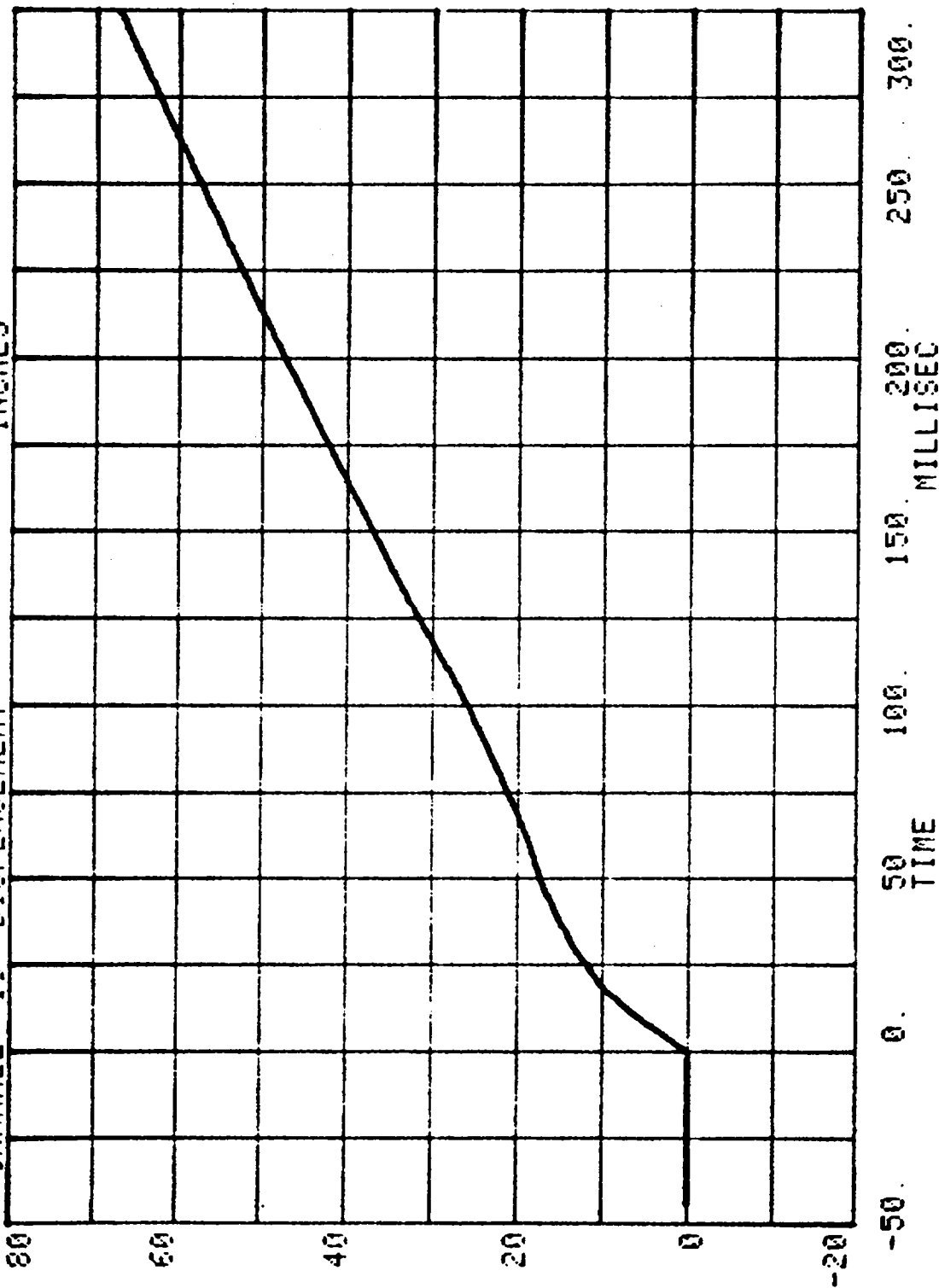
RUN= 941 SERIES= 5101  
CHANNEL 31 ACC PACK #5(X) G'S



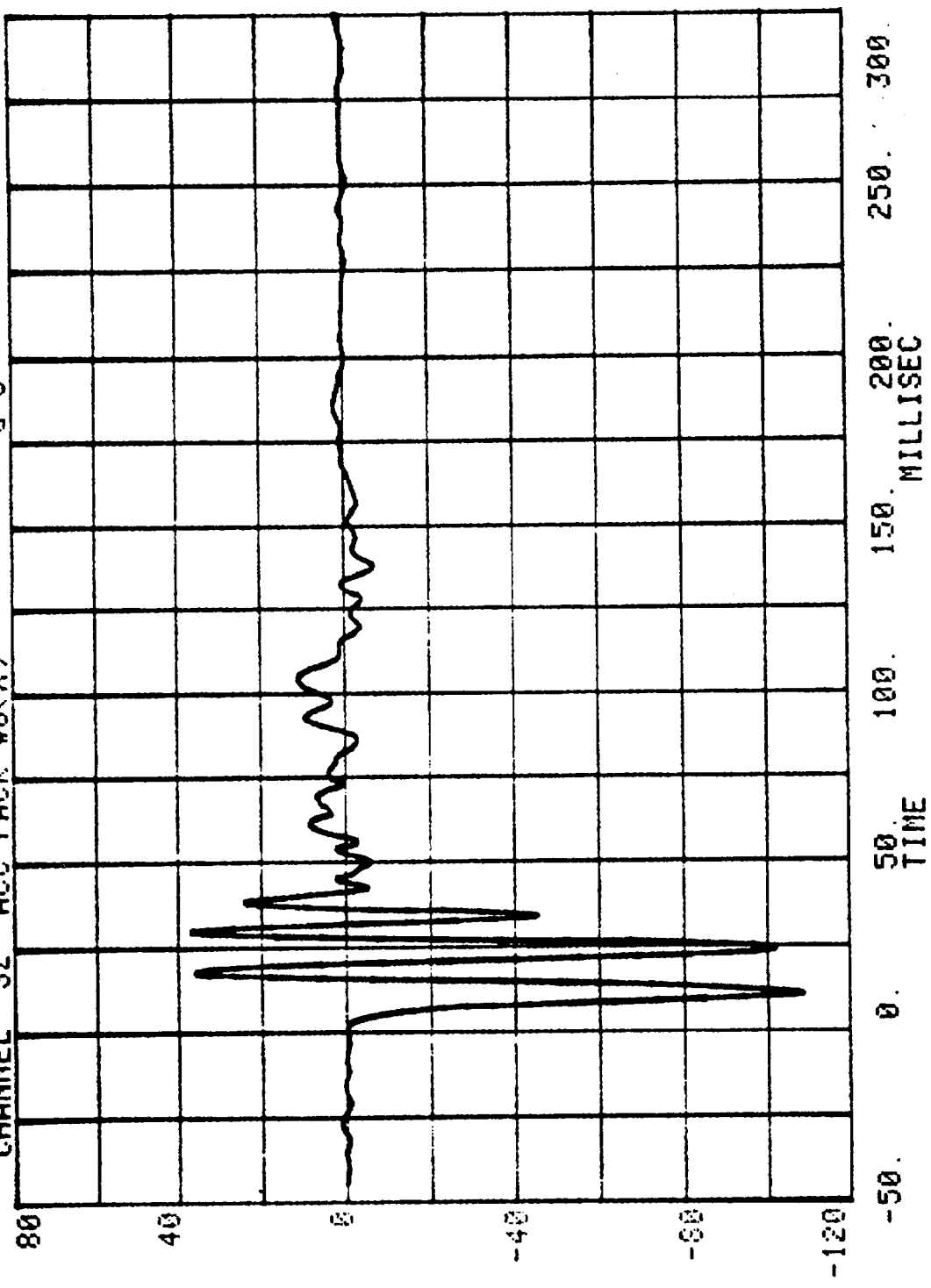


RUN= 941    SERIES= 5101    ACCEL #5 (x)

CHANNEL 10 DISPLACEMENT



CHANNEL 32 ACC PACK #6(X) RUN= 941 SERIES= 5101 G'S



ACCEL #6 (x)

MPH

SERIES= 5101

RUN= 941

VELOCITY

CHANNEL 11

40

30

20

10

0

-10

-50

0

50

100

150

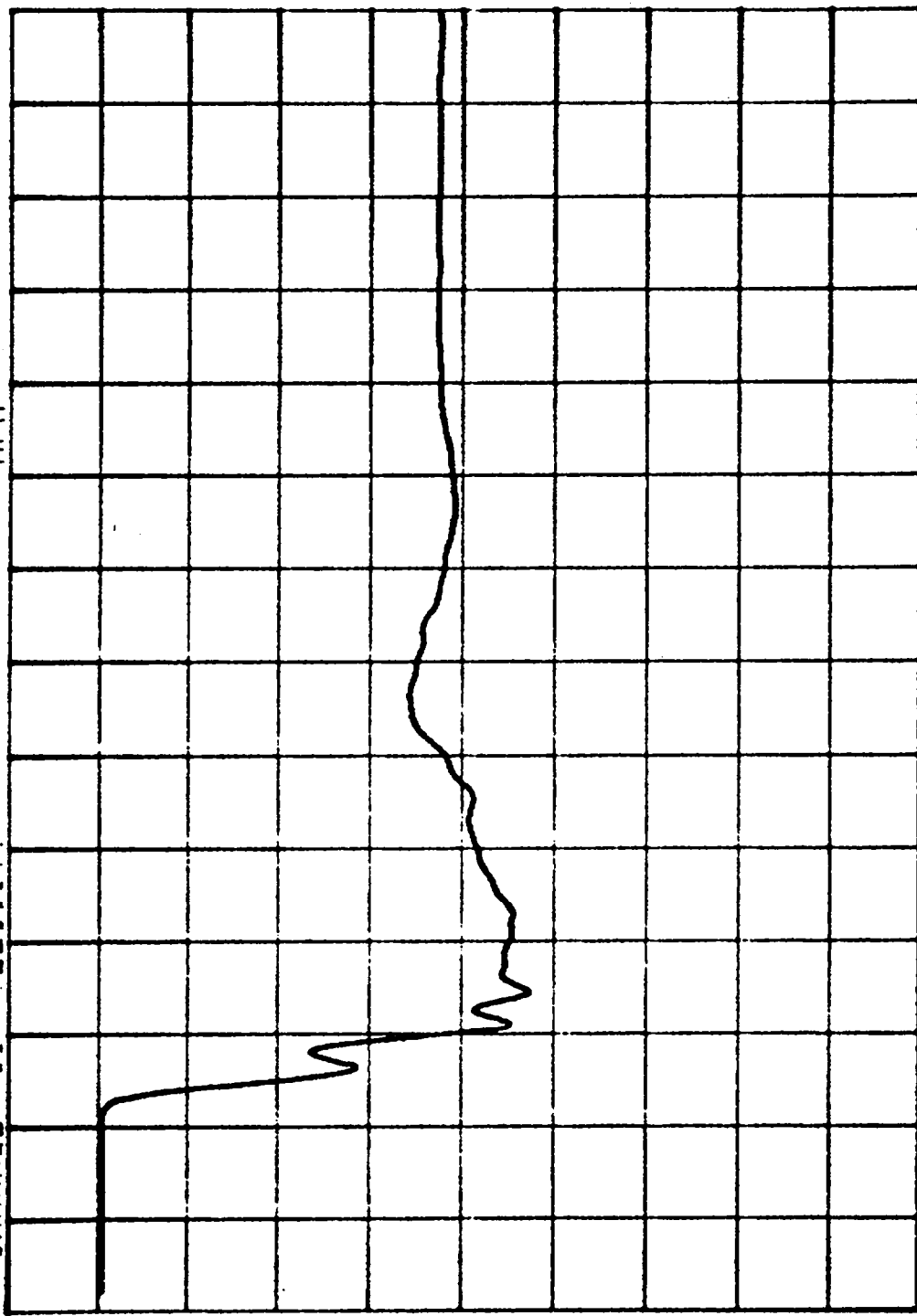
200

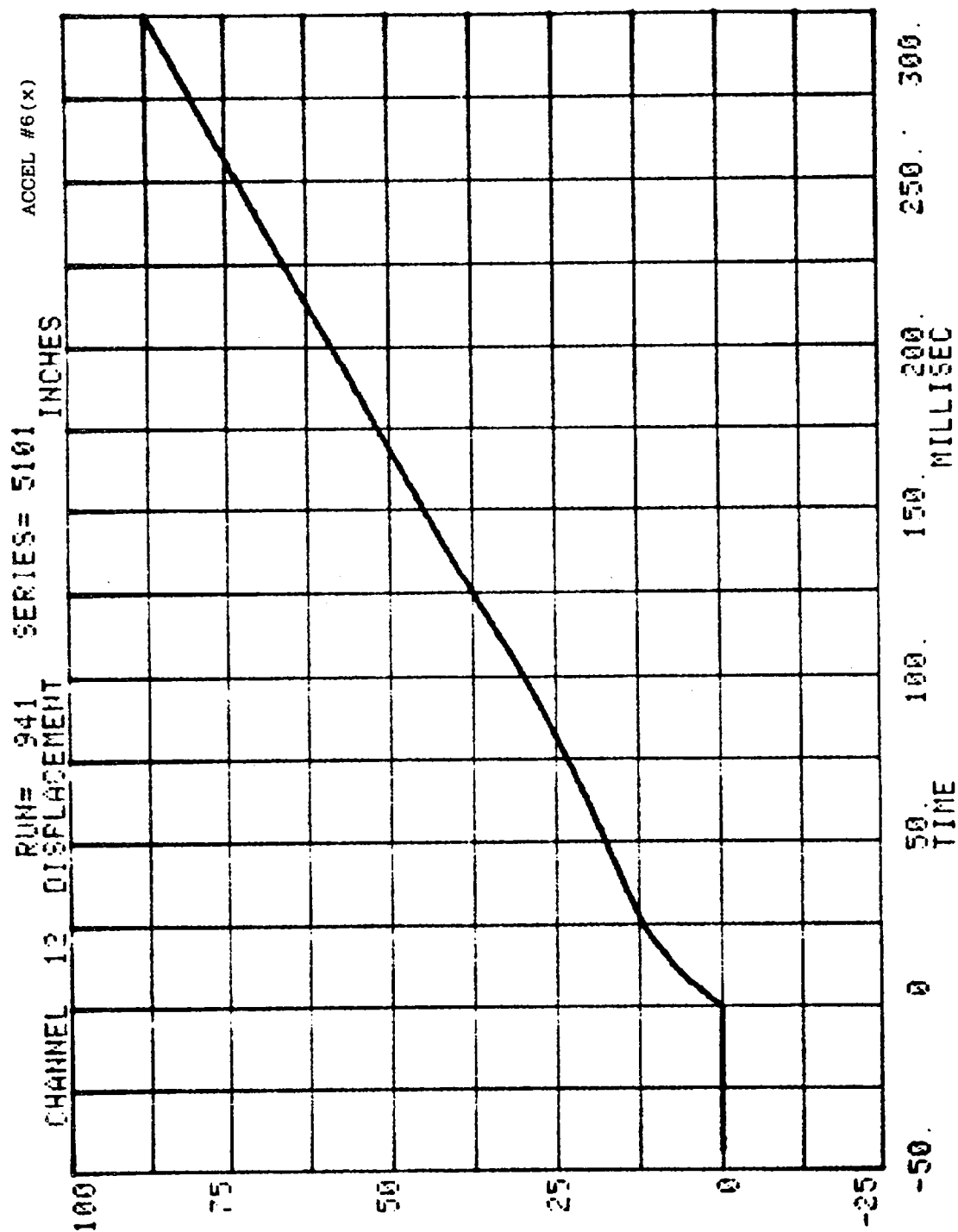
250

300

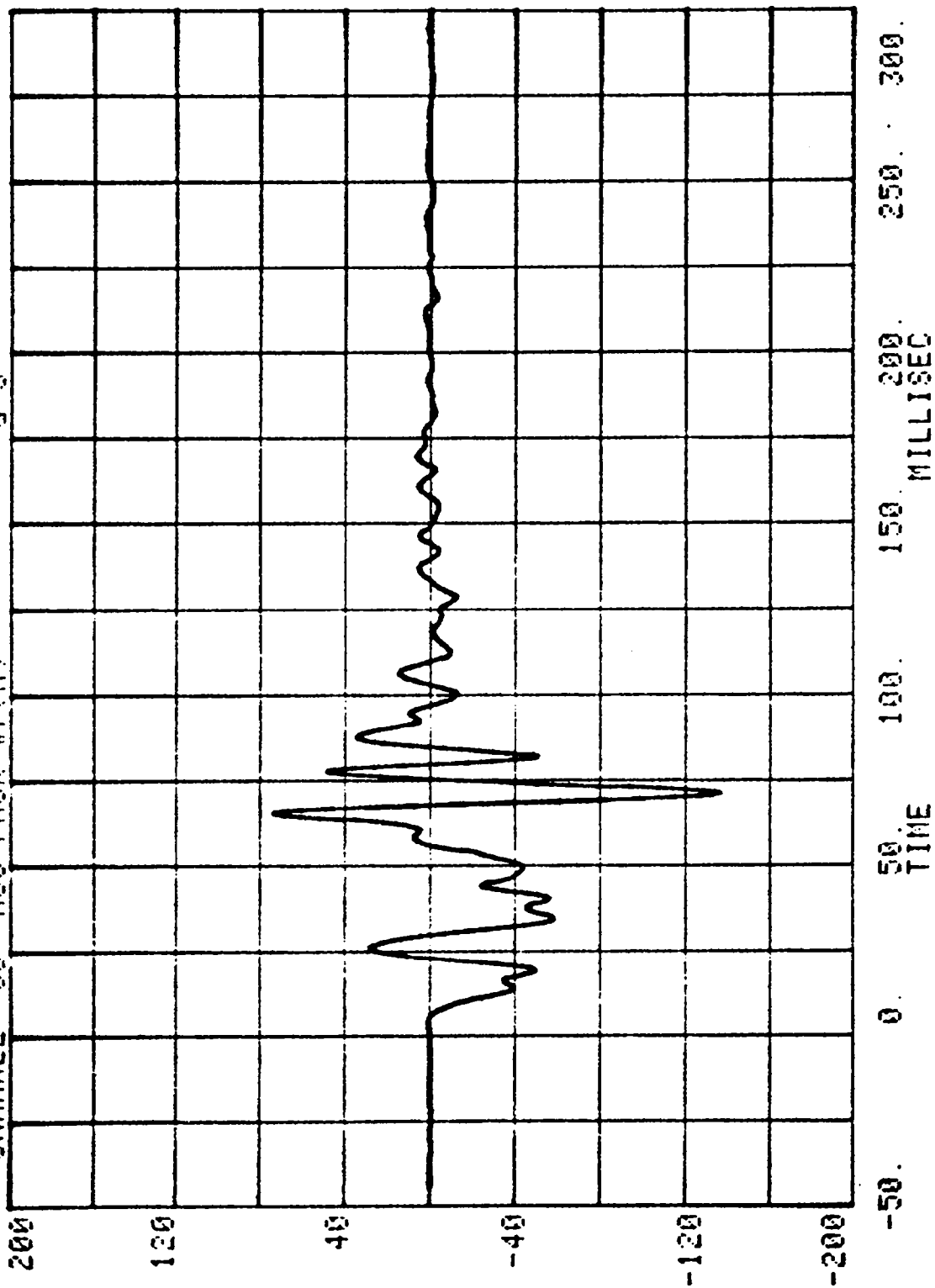
MILLISEC

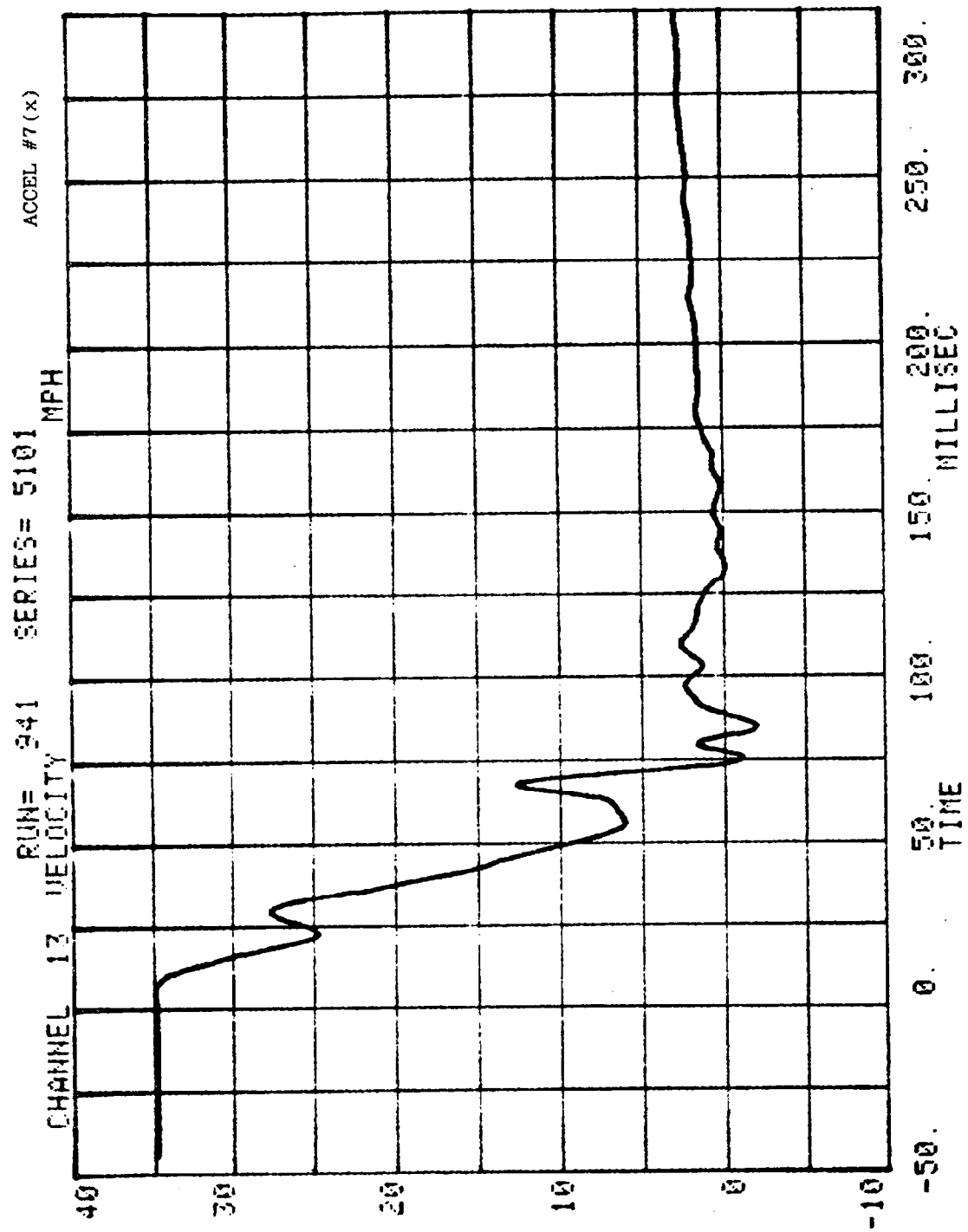
TIME

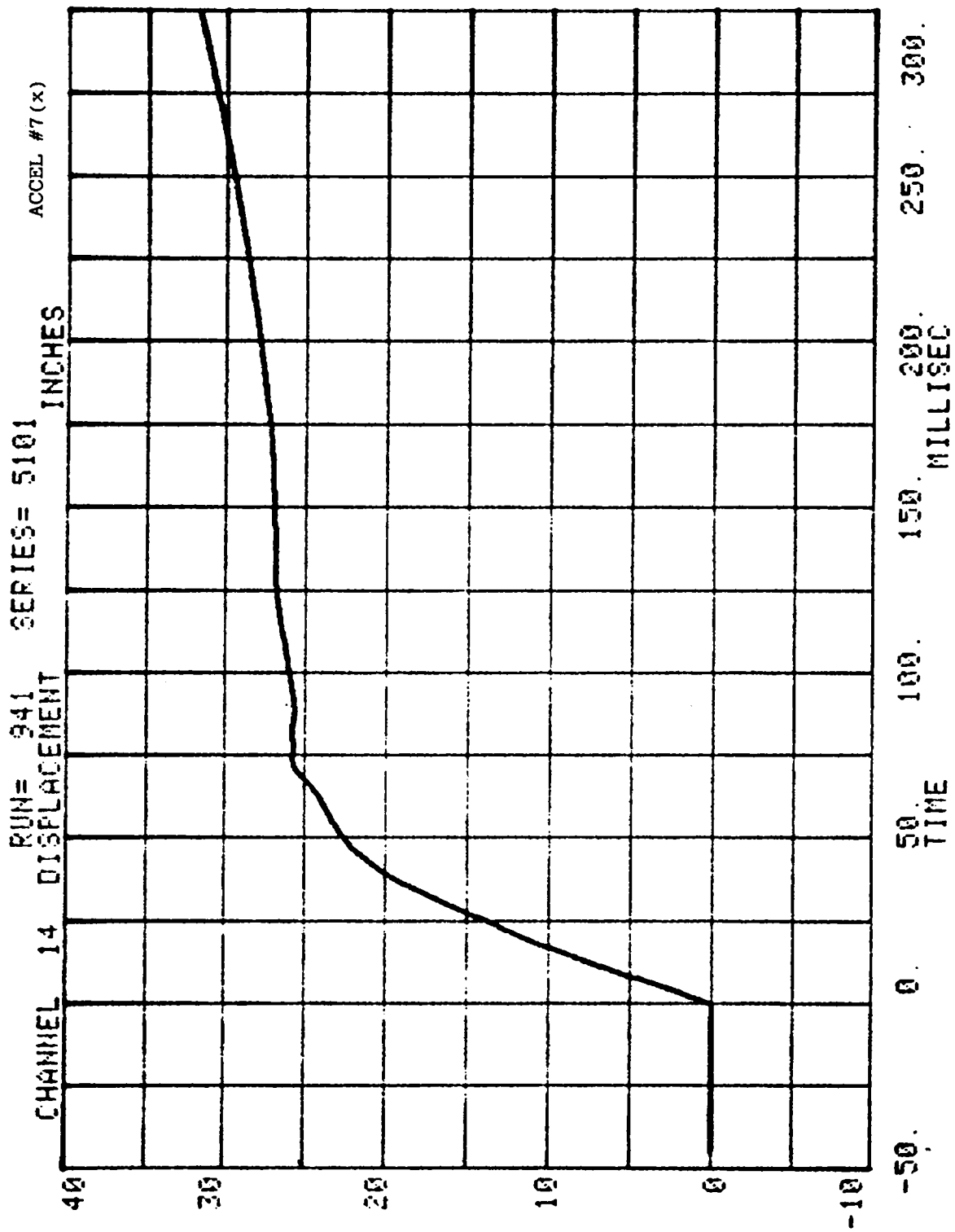




CHANNEL 33 ACC PACK #7(X) RUN= 941. SERIES= 5101 G'S







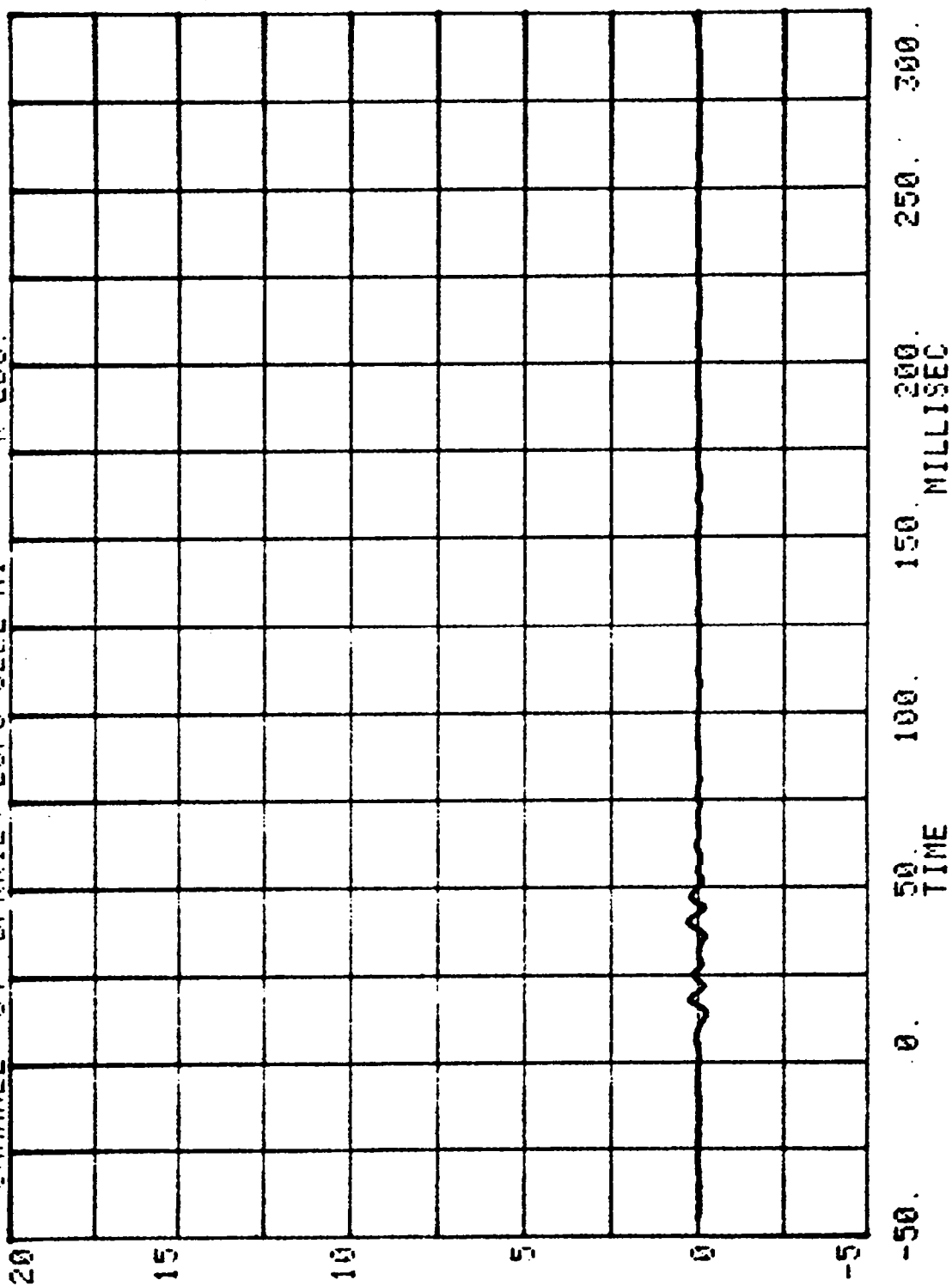
TEST NO. ML5101

LOAD CELL BARRIER DATA

FILTER CHANNEL CLASS

60

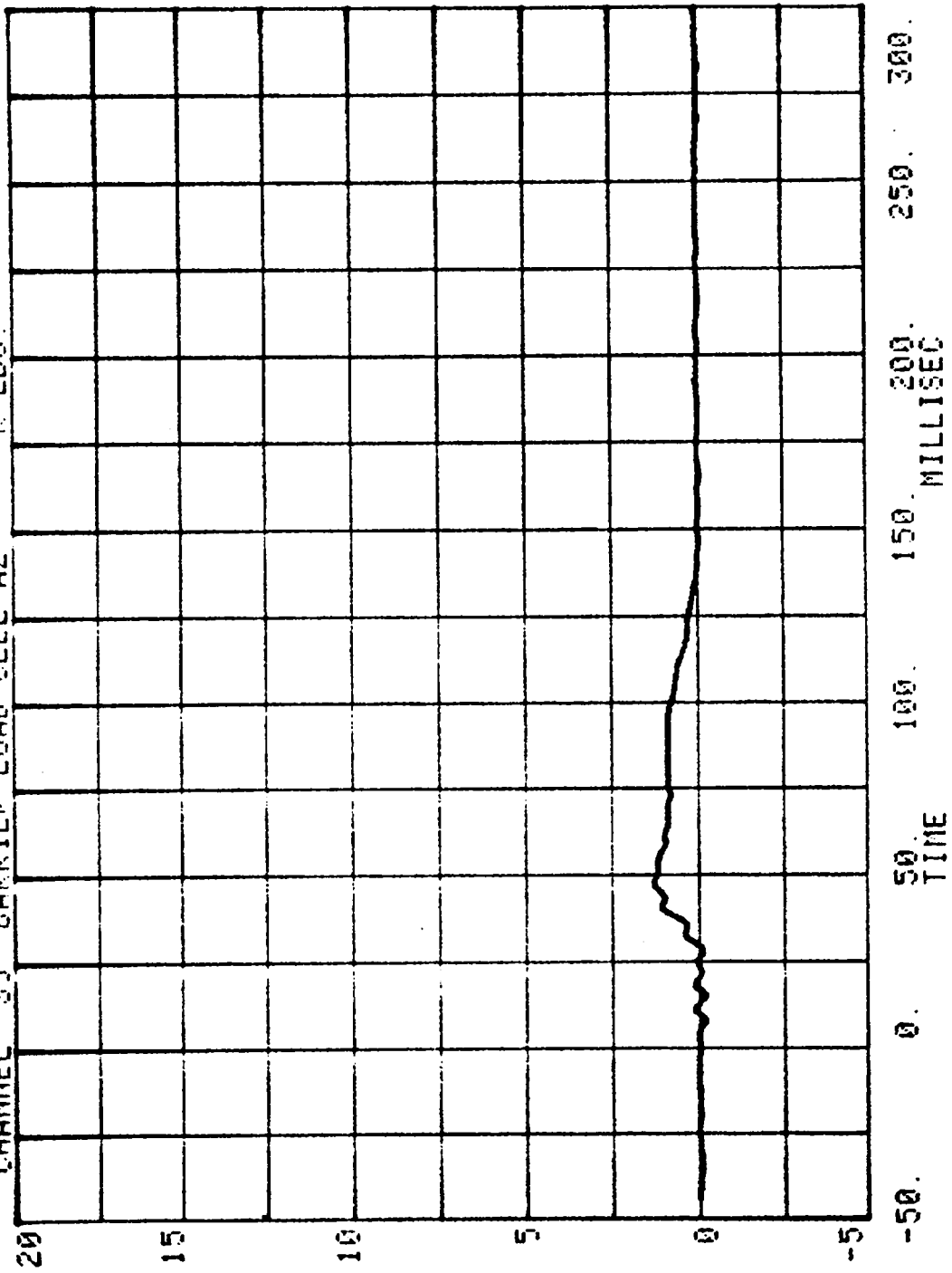
RUN= 241 SERIES= 5101  
CHANNEL 34 BARRIER LOAD CELL A1 K LBS.



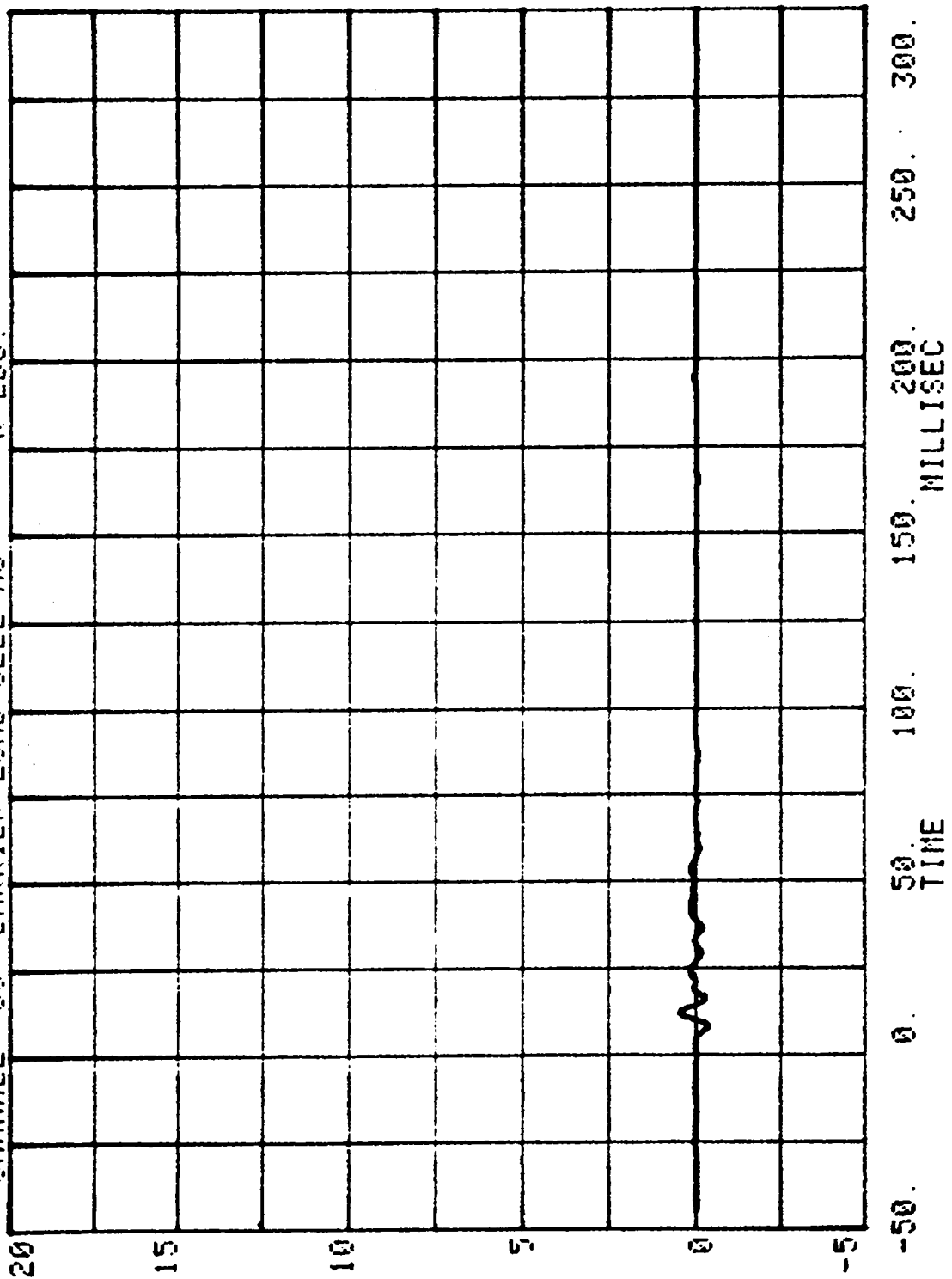
CHANNEL 35 BARRIER LOAD CELL A2

RUN= 341 SERIES= 5101

K LBS.

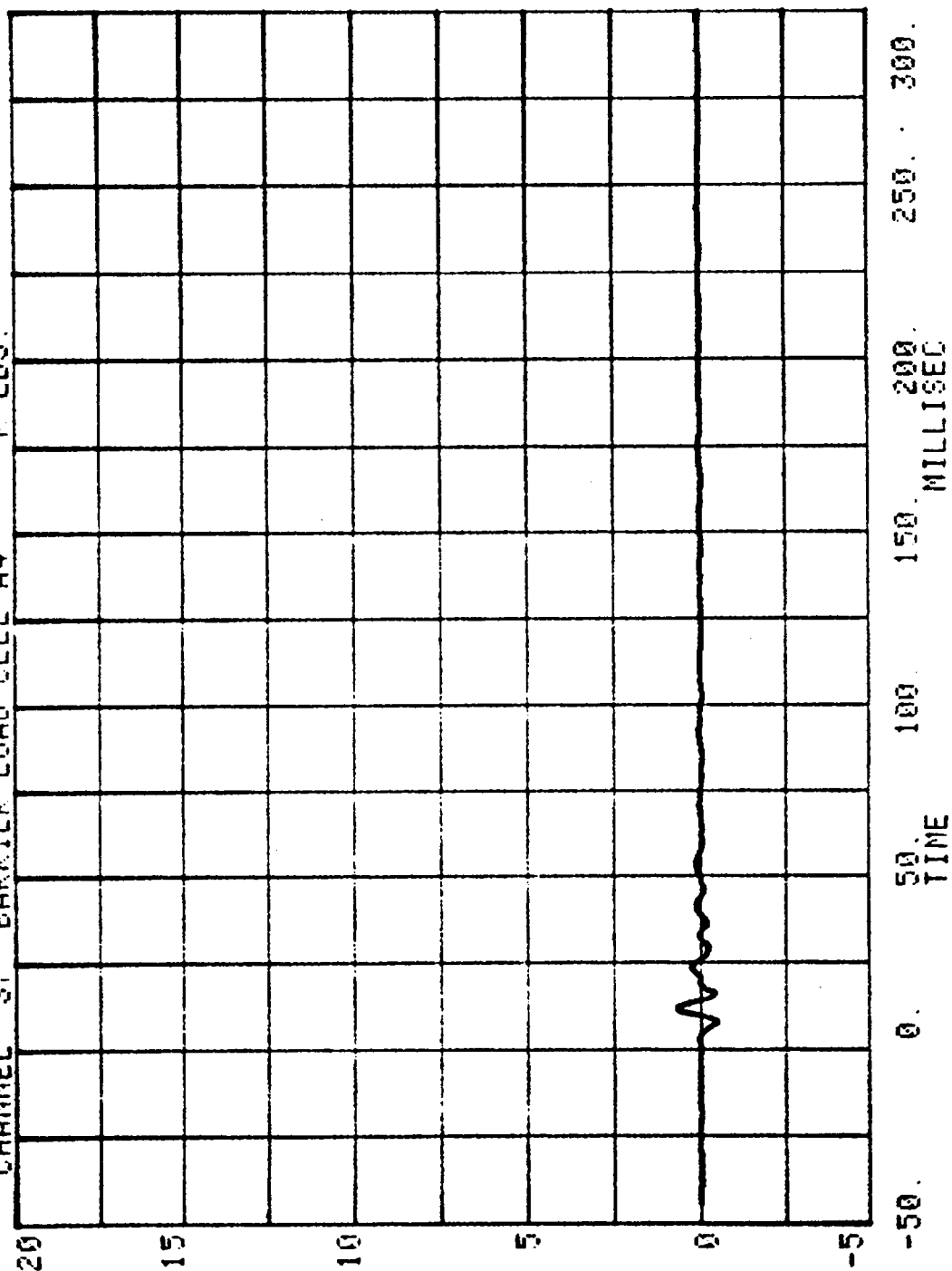


CHANNEL 36 BARRIER LOAD CELL A3 RUN= 941 SERIES= 5101 K LBS.

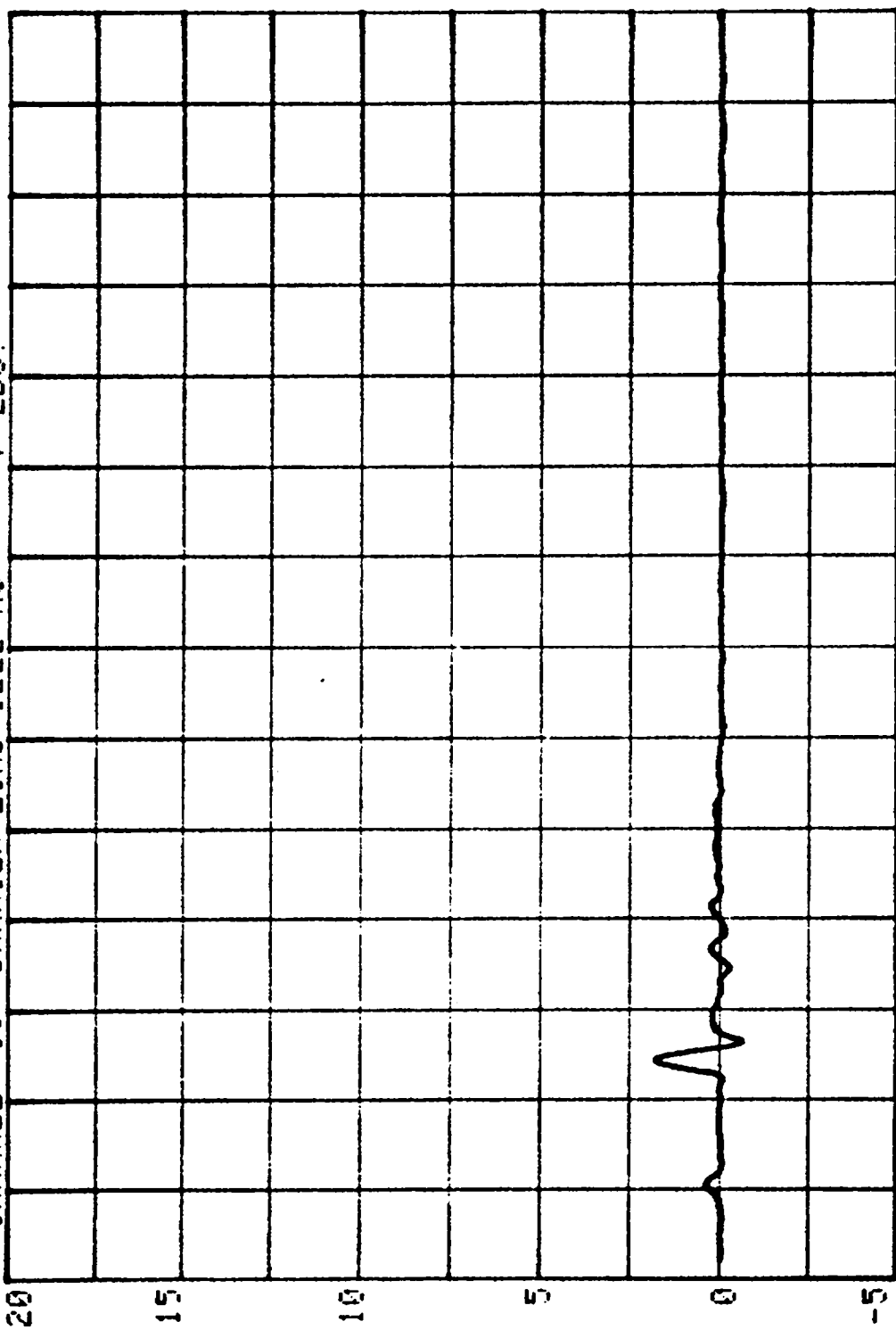


CHANNEL 37 BARRIER LOAD CELL A4 K LBS.

RUN= 941 SERIES= 5101



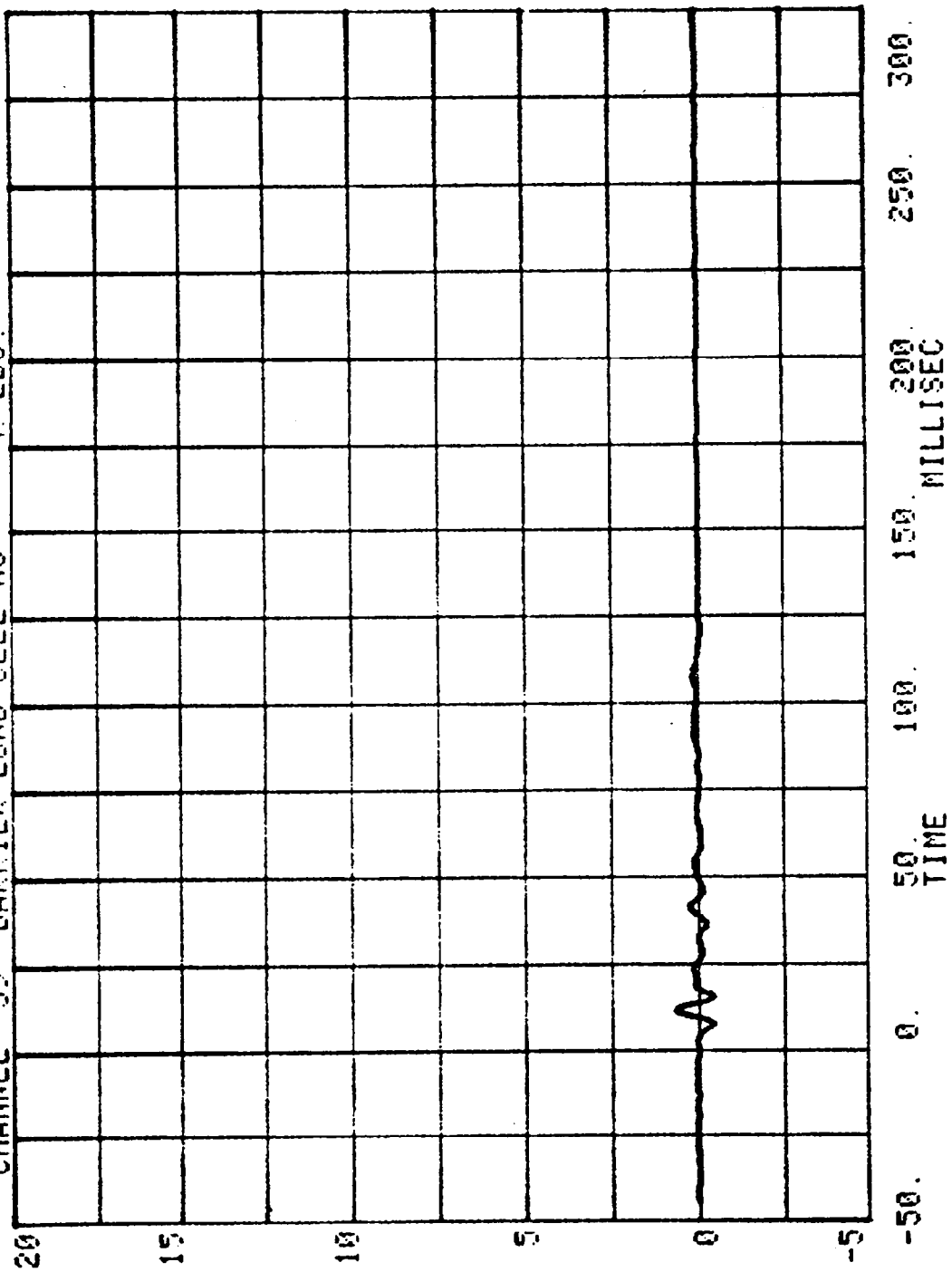
CHANNEL 38 BARRIER LOAD CELL A5  
PUN= 941 SERIES= 5101 K LBS.



-50. 0. 50. 100. 150. 200. 250. 300.  
TIME MILLISEC

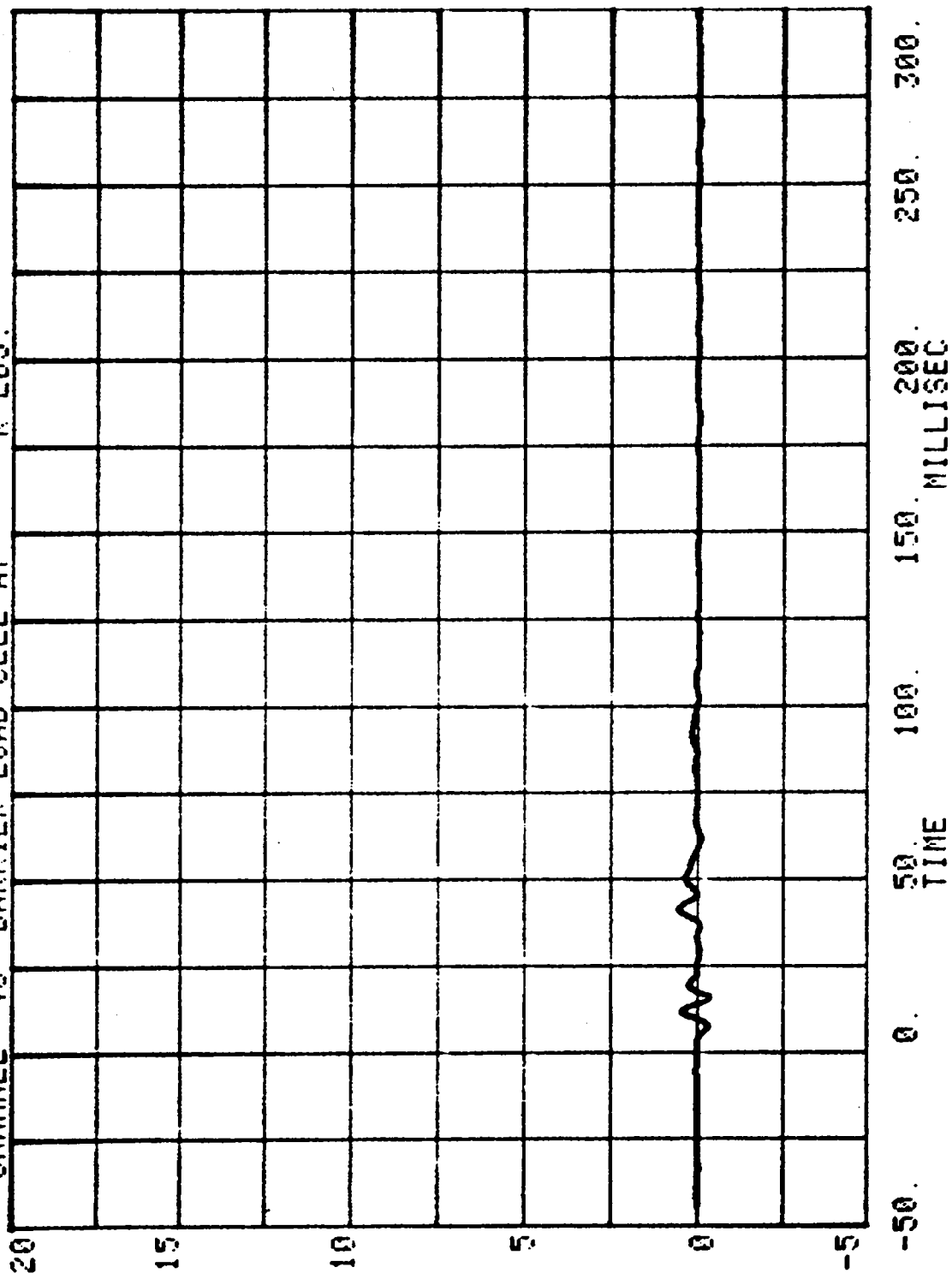
CHANNEL 39 BARRIER LOAD CELL A6 K LBS.

RUN= 941 SERIES= 5101



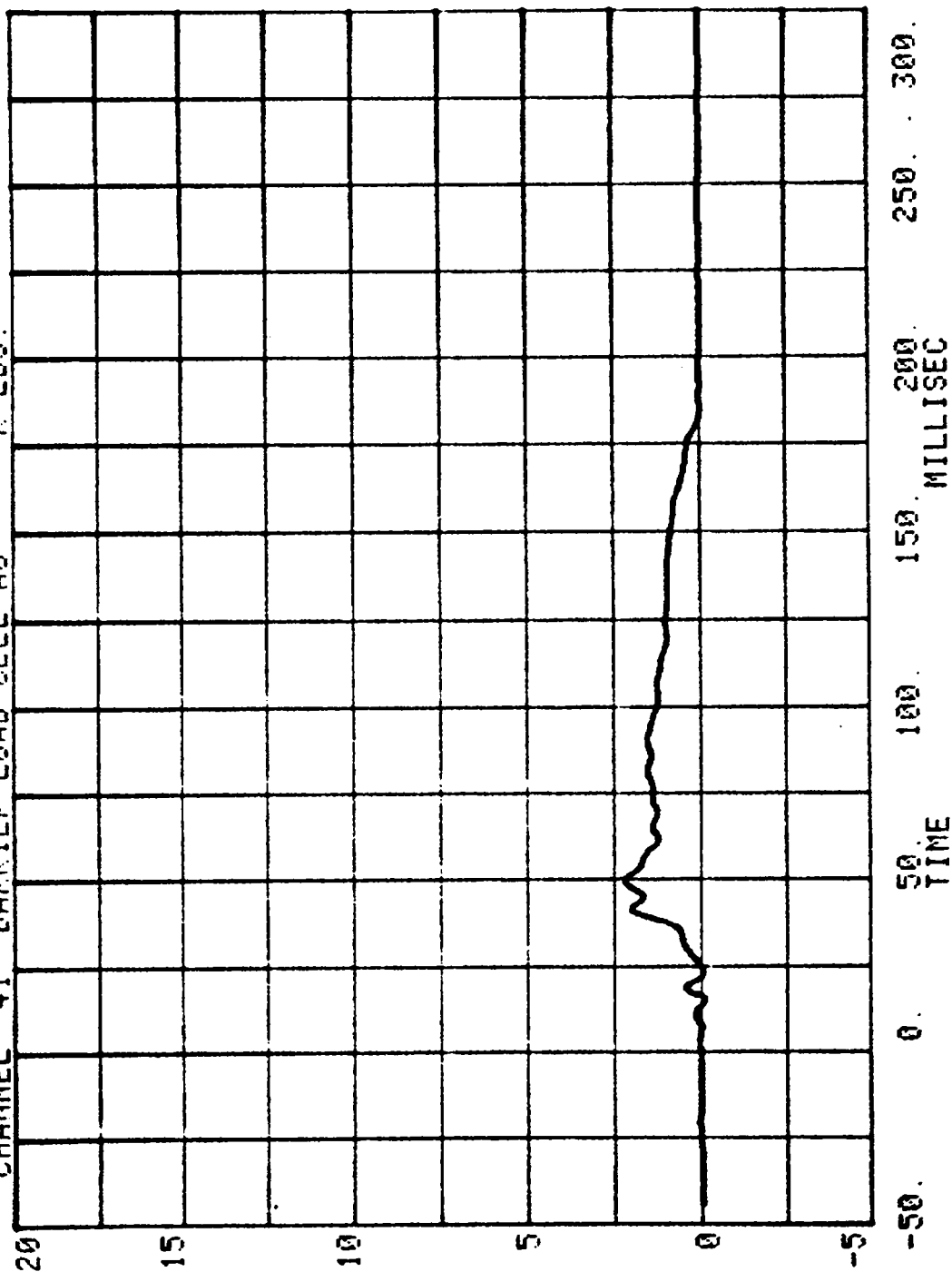
CHANNEL 40 BARRIER LOAD CELL #7 K LBS.

RUN= 941 SERIES= 5101

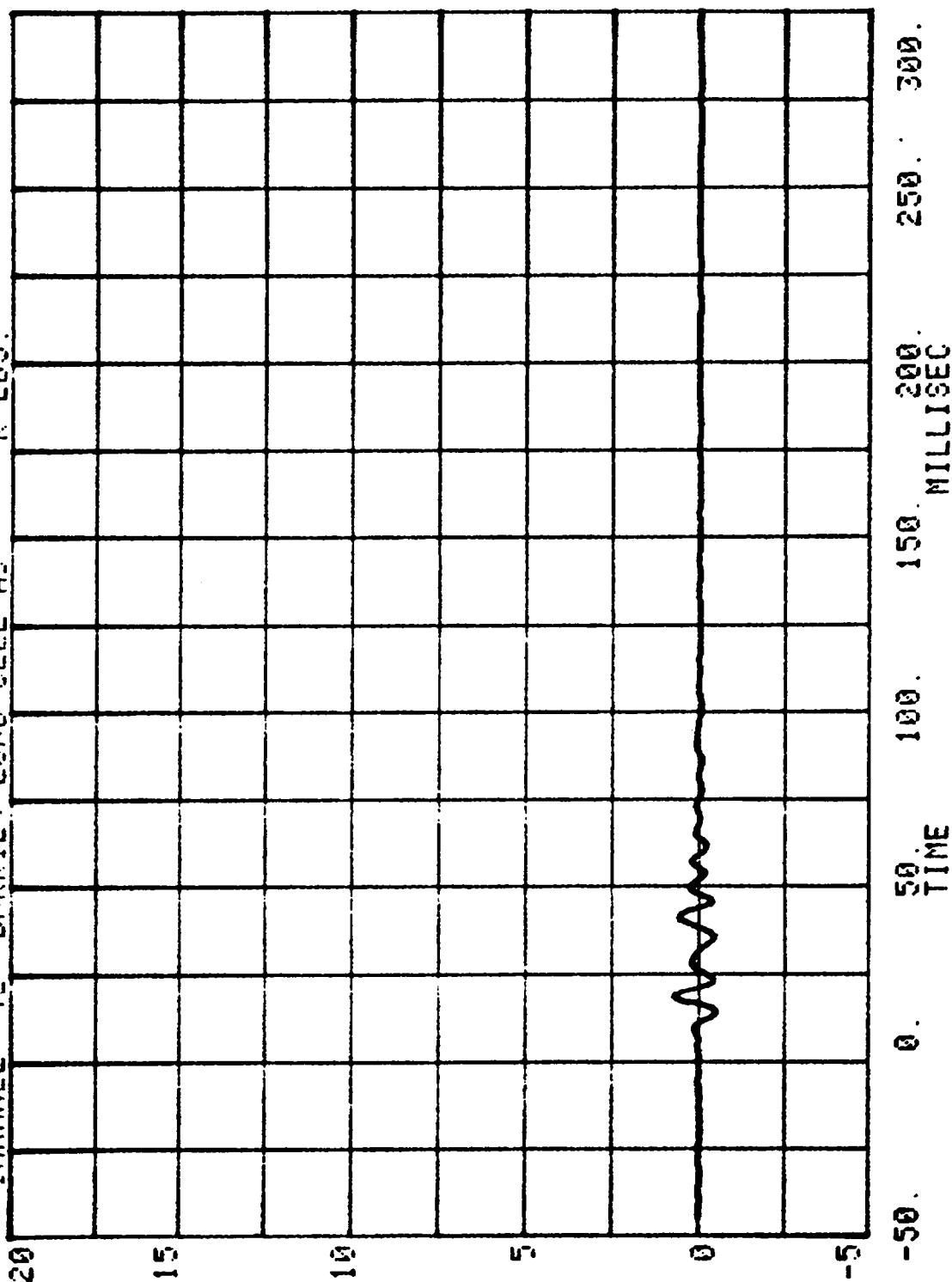


CHANNEL 41 BARRIER LOAD CELL A3 K LBS.

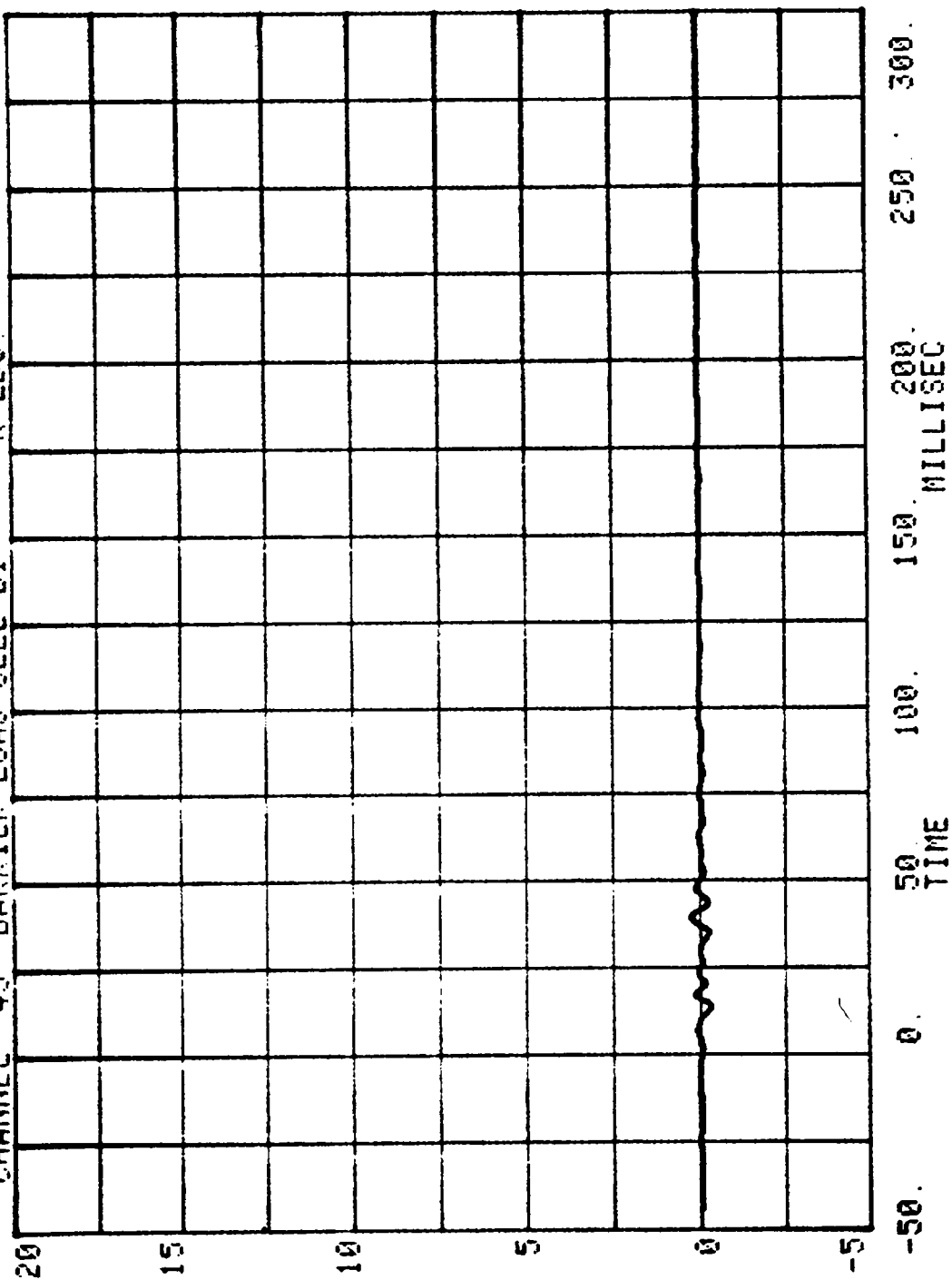
RUN= 341 SERIES= 5101



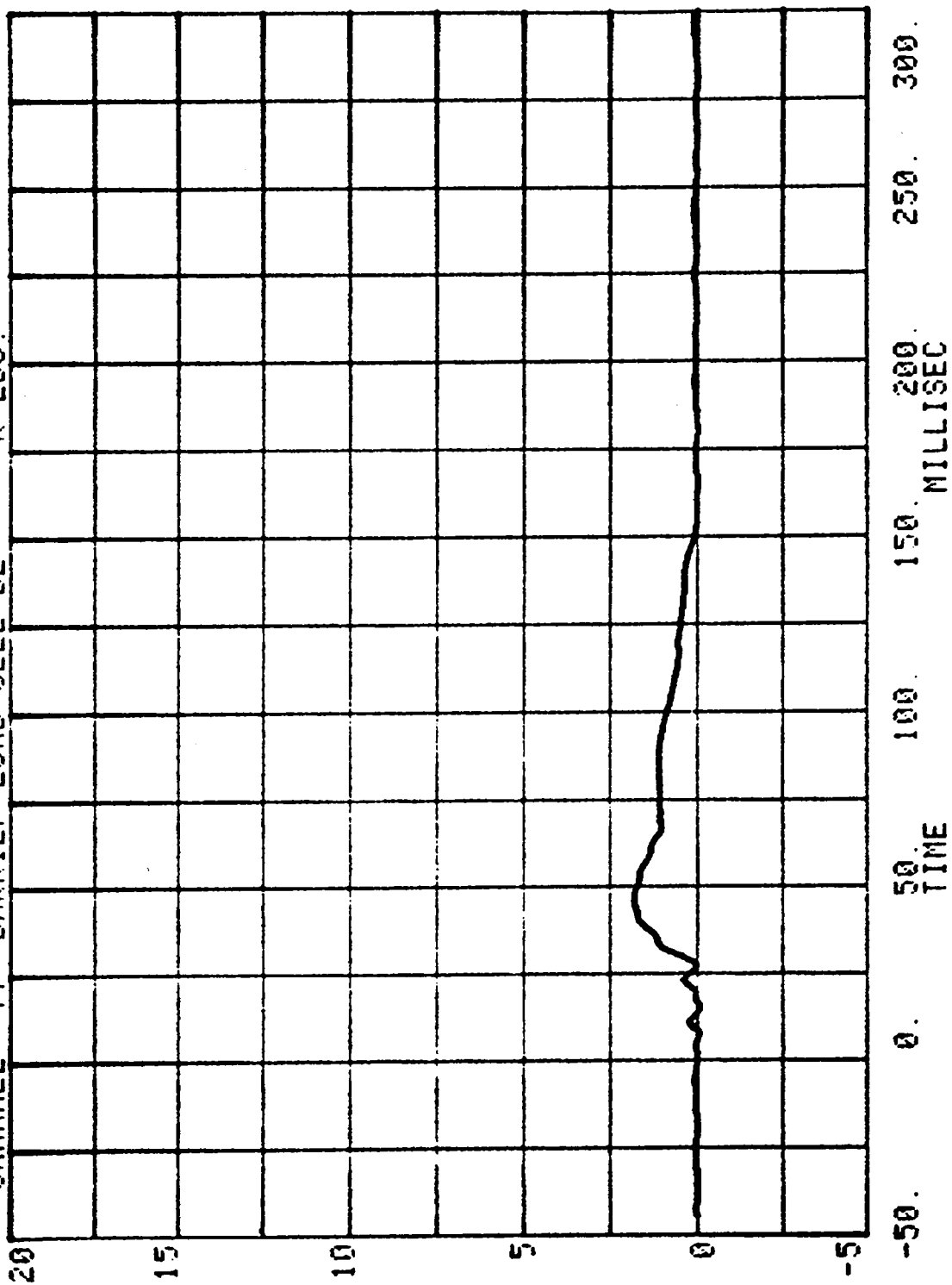
RUN= 941 SERIES= 5101  
CHANNEL 42 BARRIER LOAD CELL A2 K LBS.



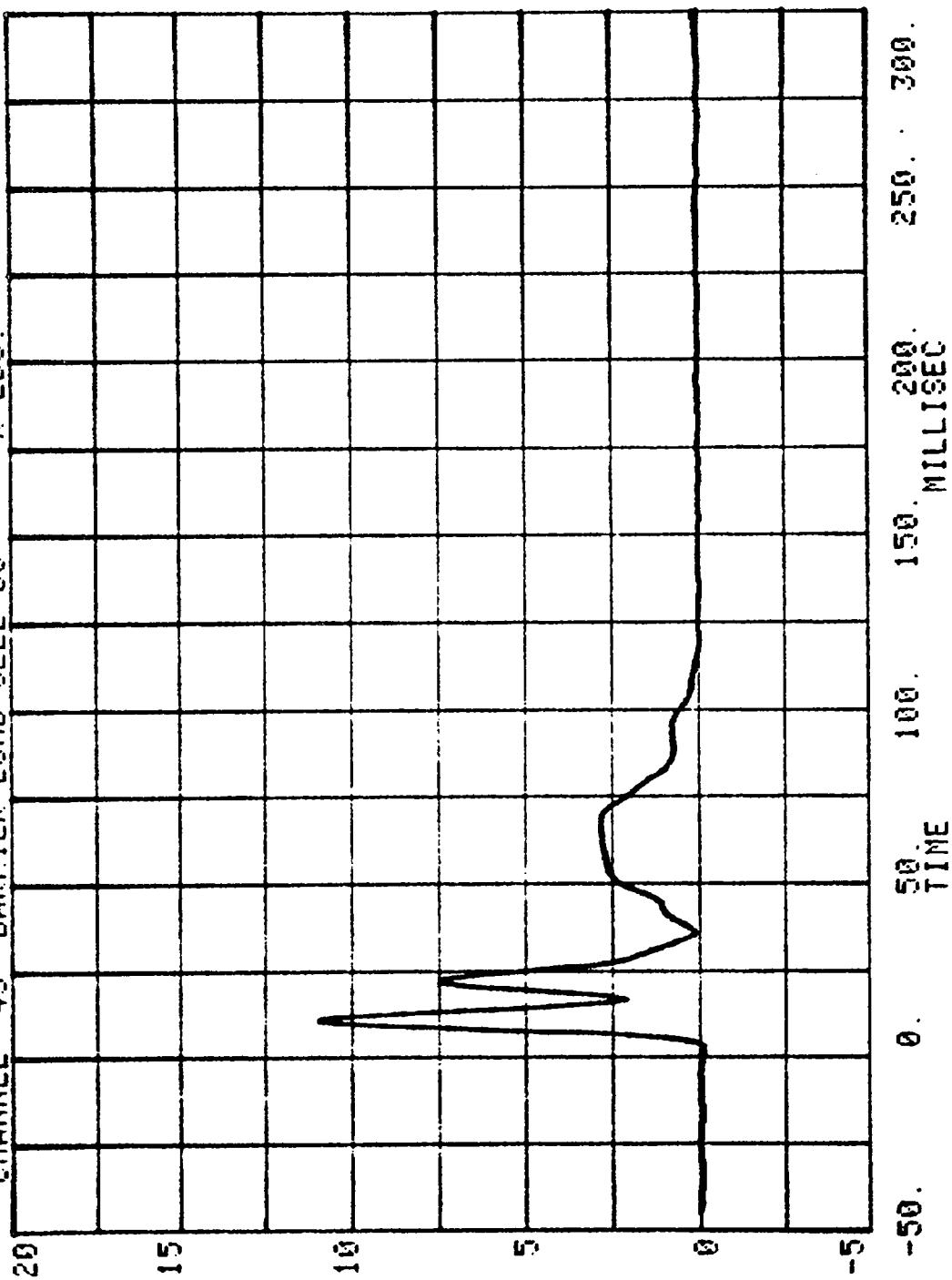
CHANNEL 43 BARRIER LOAD CELL B1  
RUN= 941 SERIES= 5101 K LBS.



CHANNEL 44 RUN= 941 SERIES= 5101  
BARRIER LOAD CELL B2 K LBS.

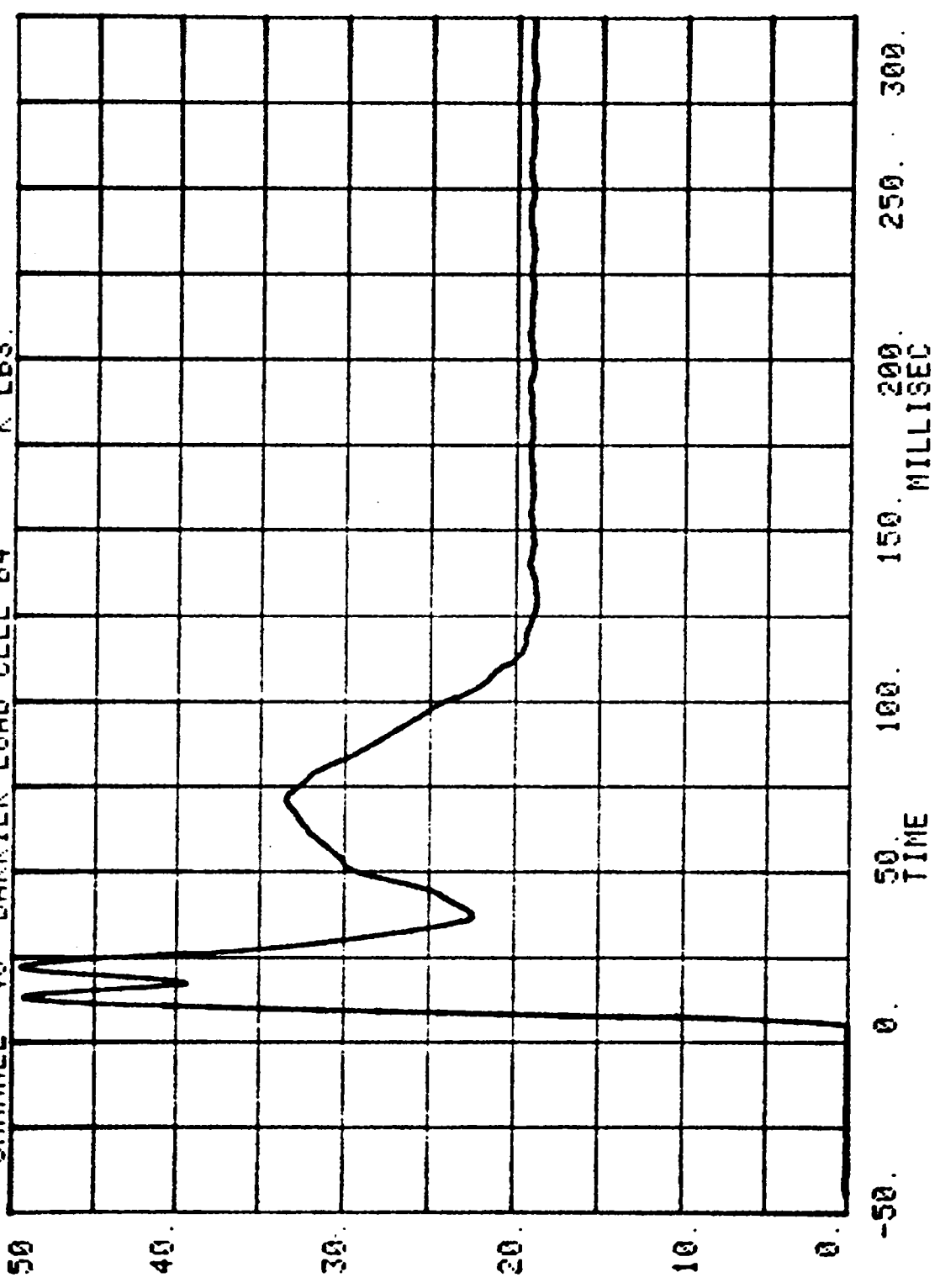


CHANNEL 45 BARRIER LOAD CELL 83 K LBS.  
RUN= 941 SERIES= 5101

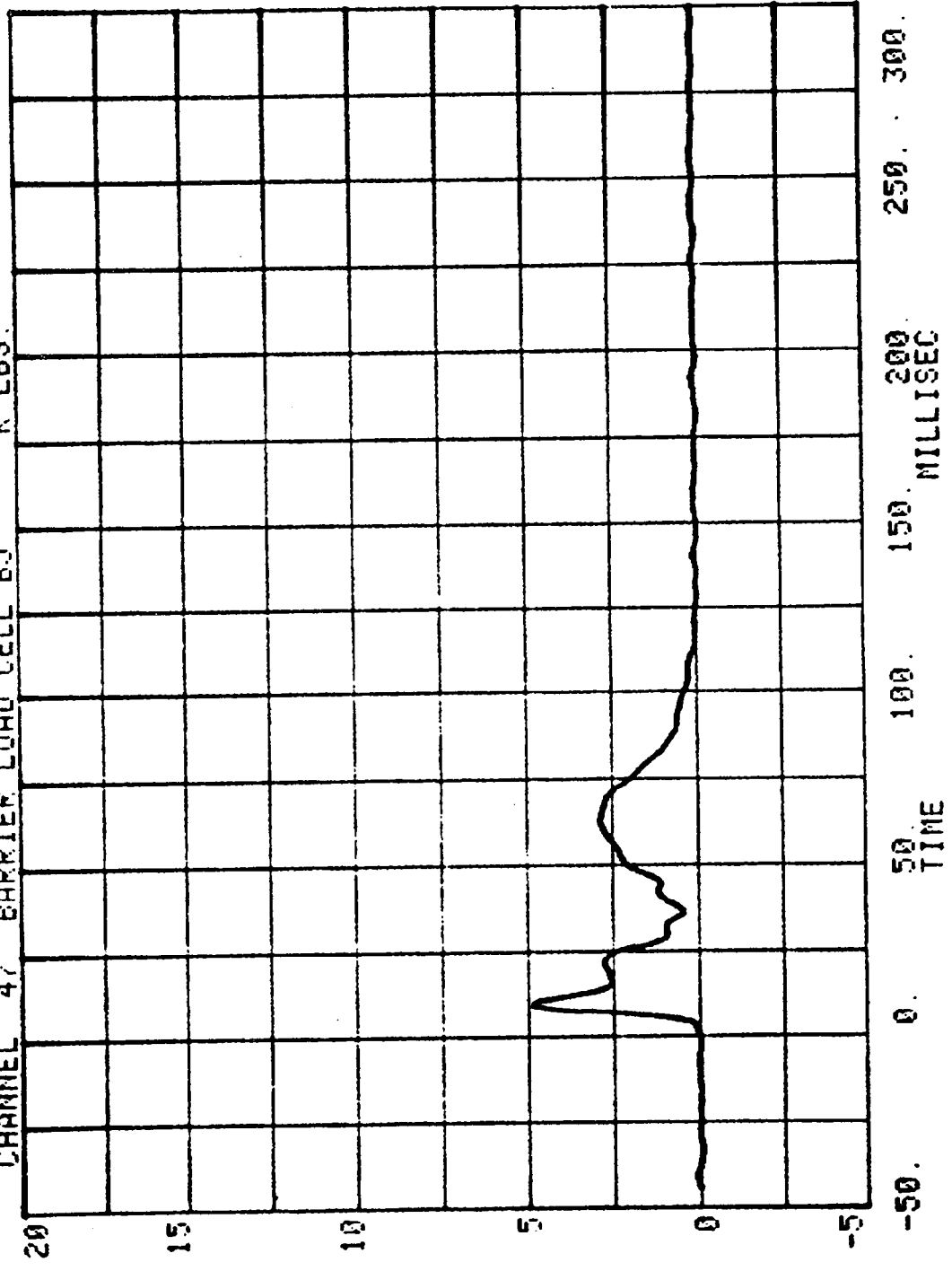


CHANNEL 46 BARRIER LOAD CELL B4 K LBS.

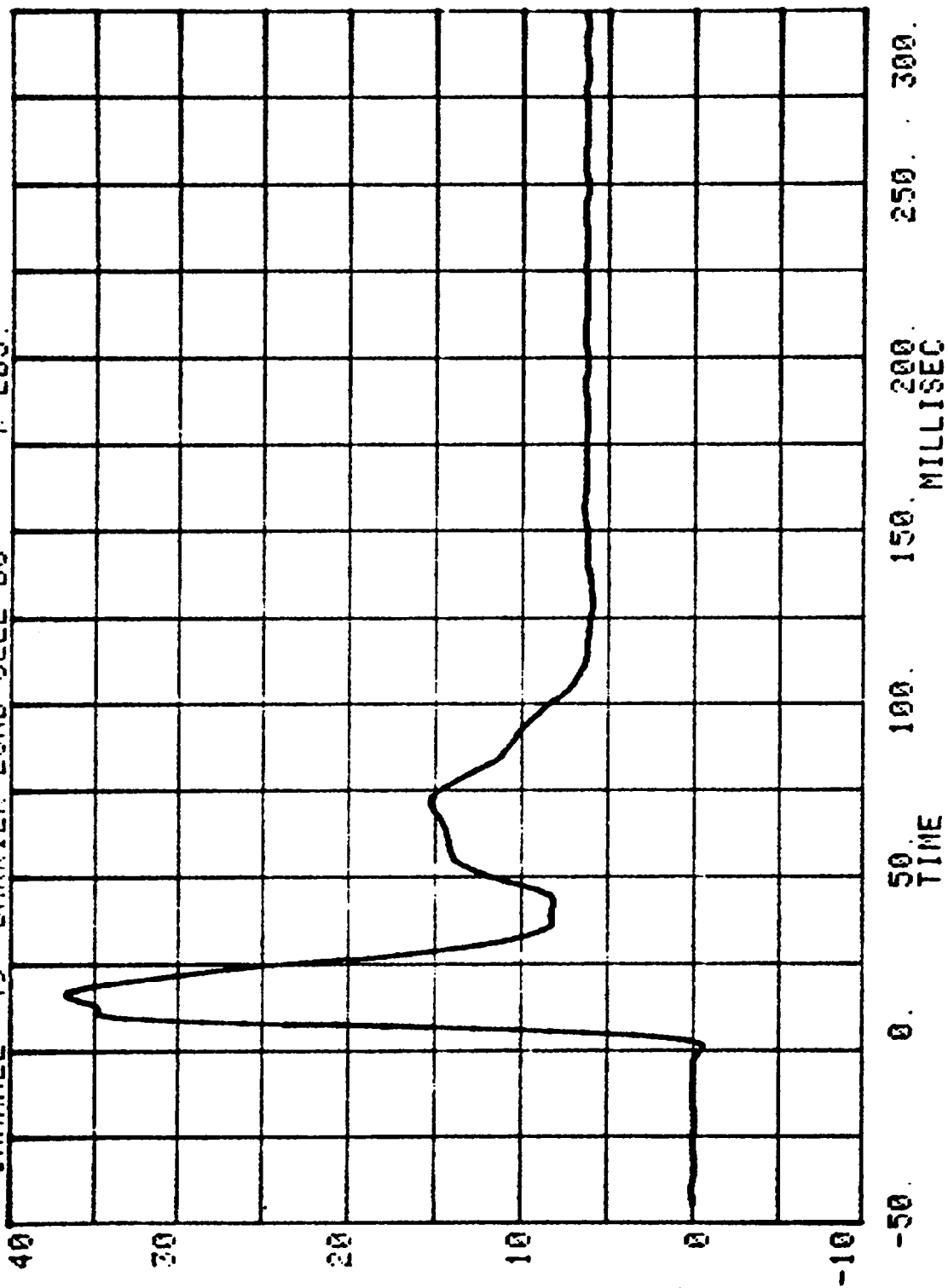
RUN= 941 SERIES= 5101



CHANNEL 47 BARRIER LOAD CELL B5 RUN= 341 SERIES= 5101 K LBS.

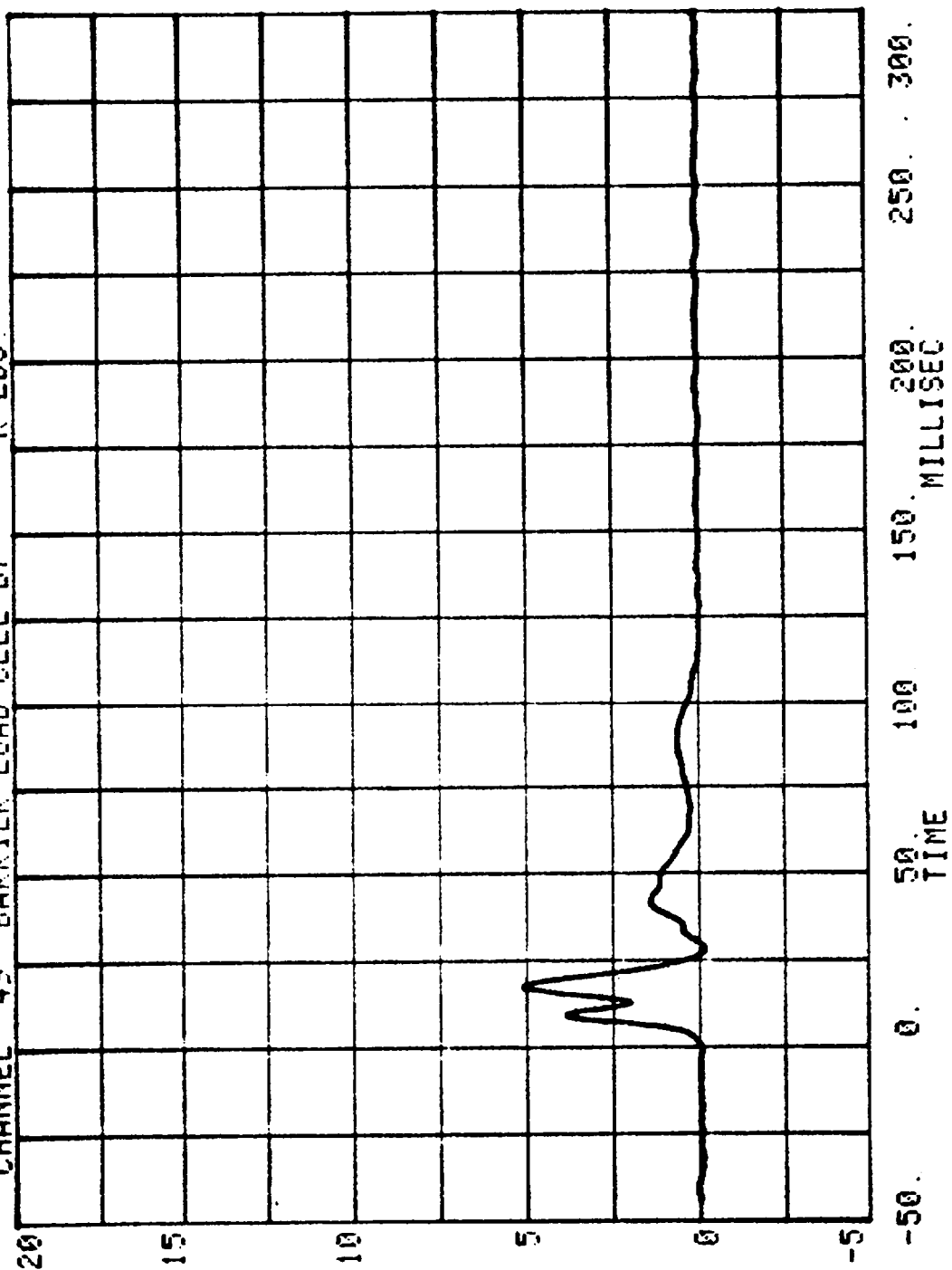


RUN= 941 SERIES= 5101  
CHANNEL 48 BARRIER LOAD CELL B6 K LBS.

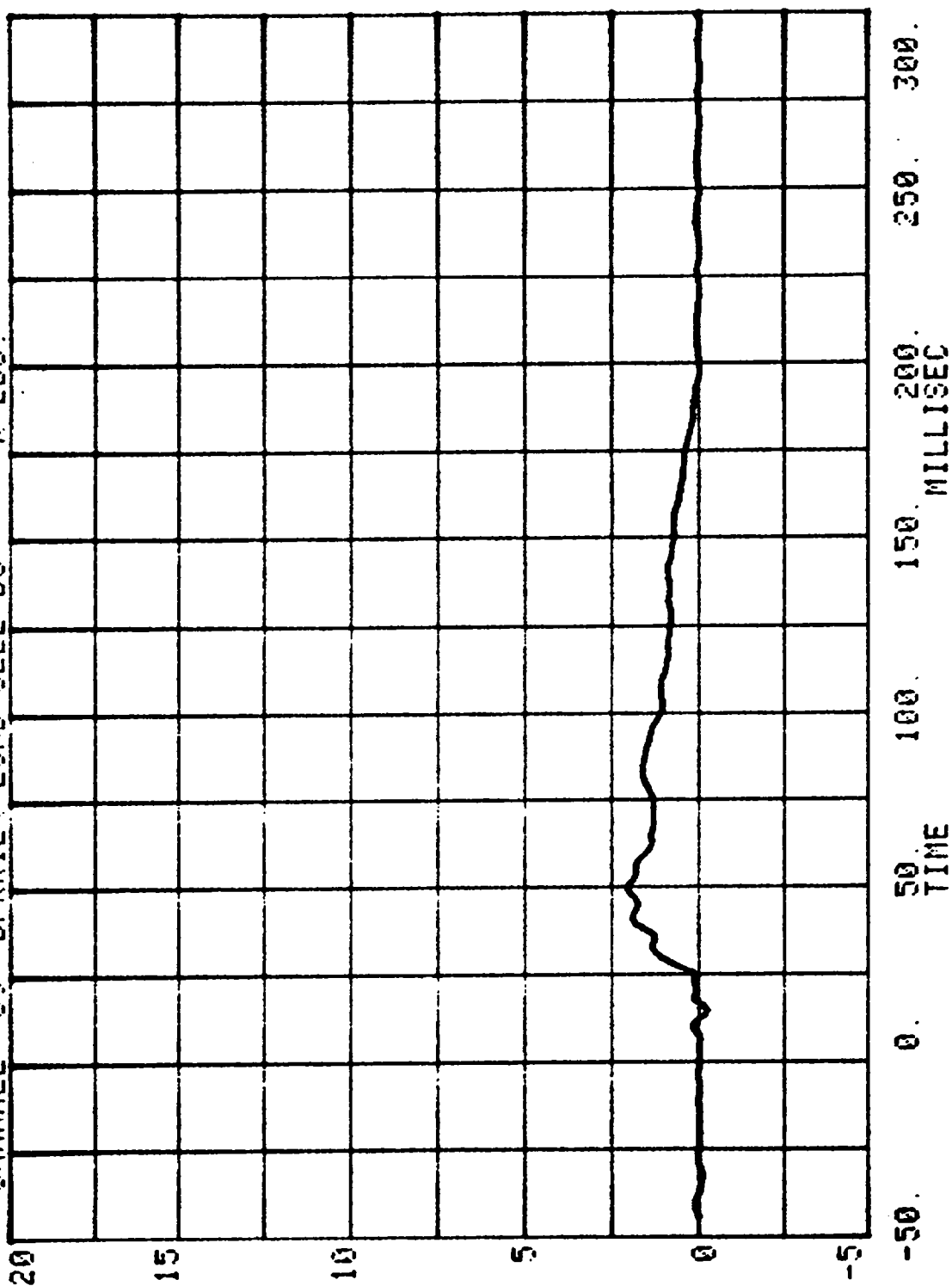


CHANNEL 49 BARRIER LOAD CELL B7 K LBS

RUN= 941 SERIES= 5101

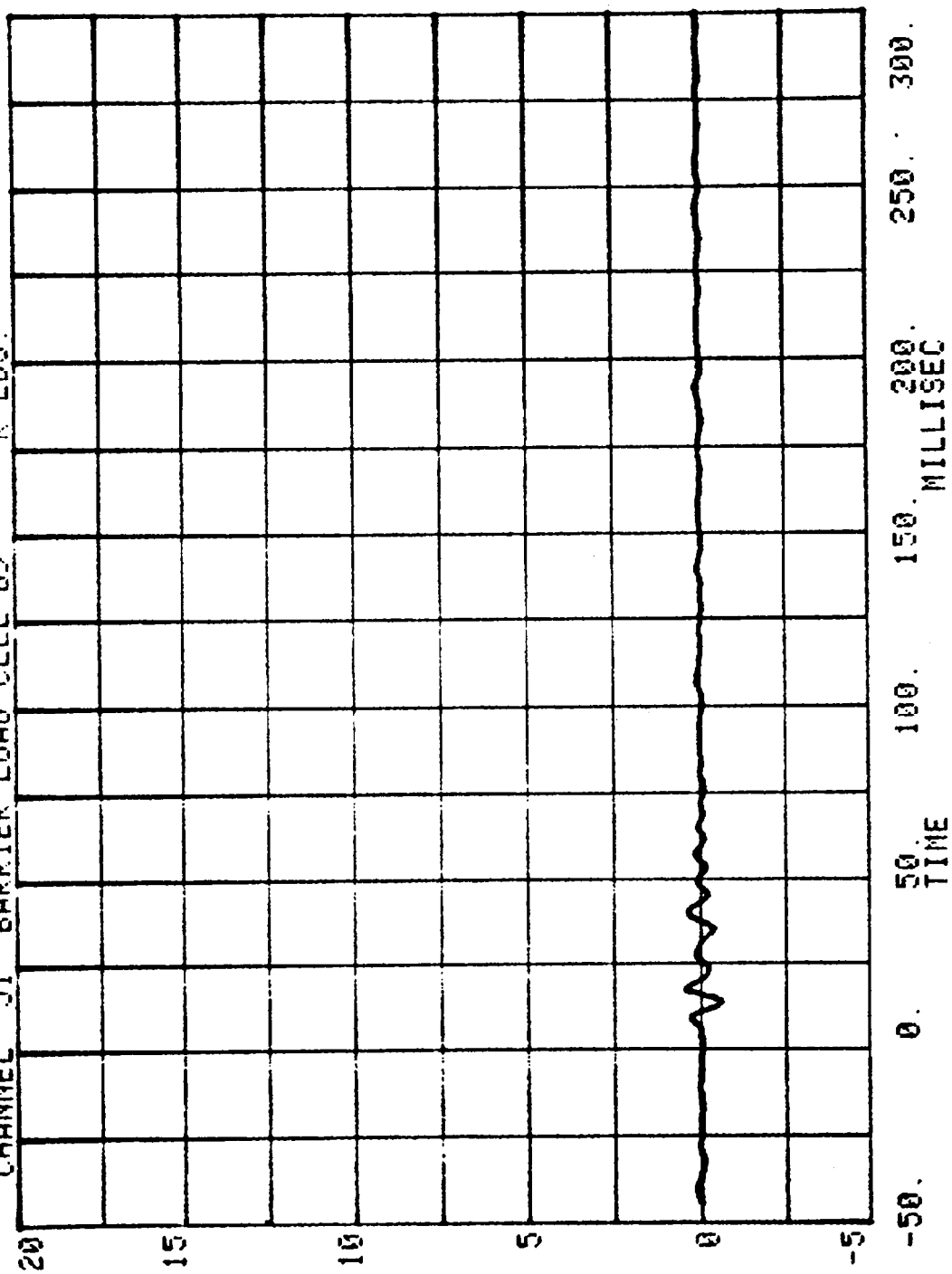


RUN= 941 SERIES= 5101  
CHANNEL 50 BARRIER LOAD CELL B8 K LBS.

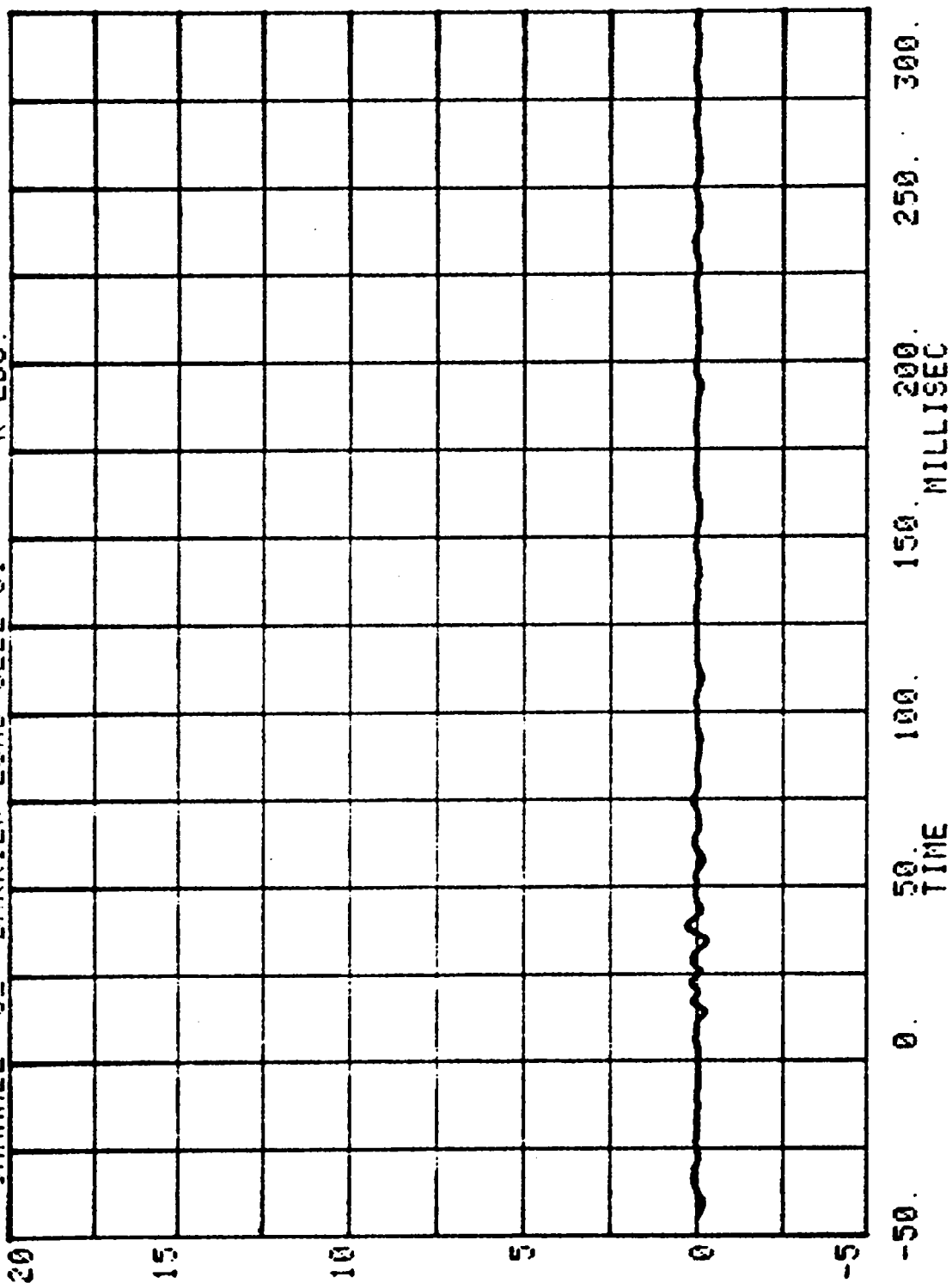


CHANNEL 51 BARRIER LOAD CELL B9 K LBS.

RUN= 941 SERIES= 5101

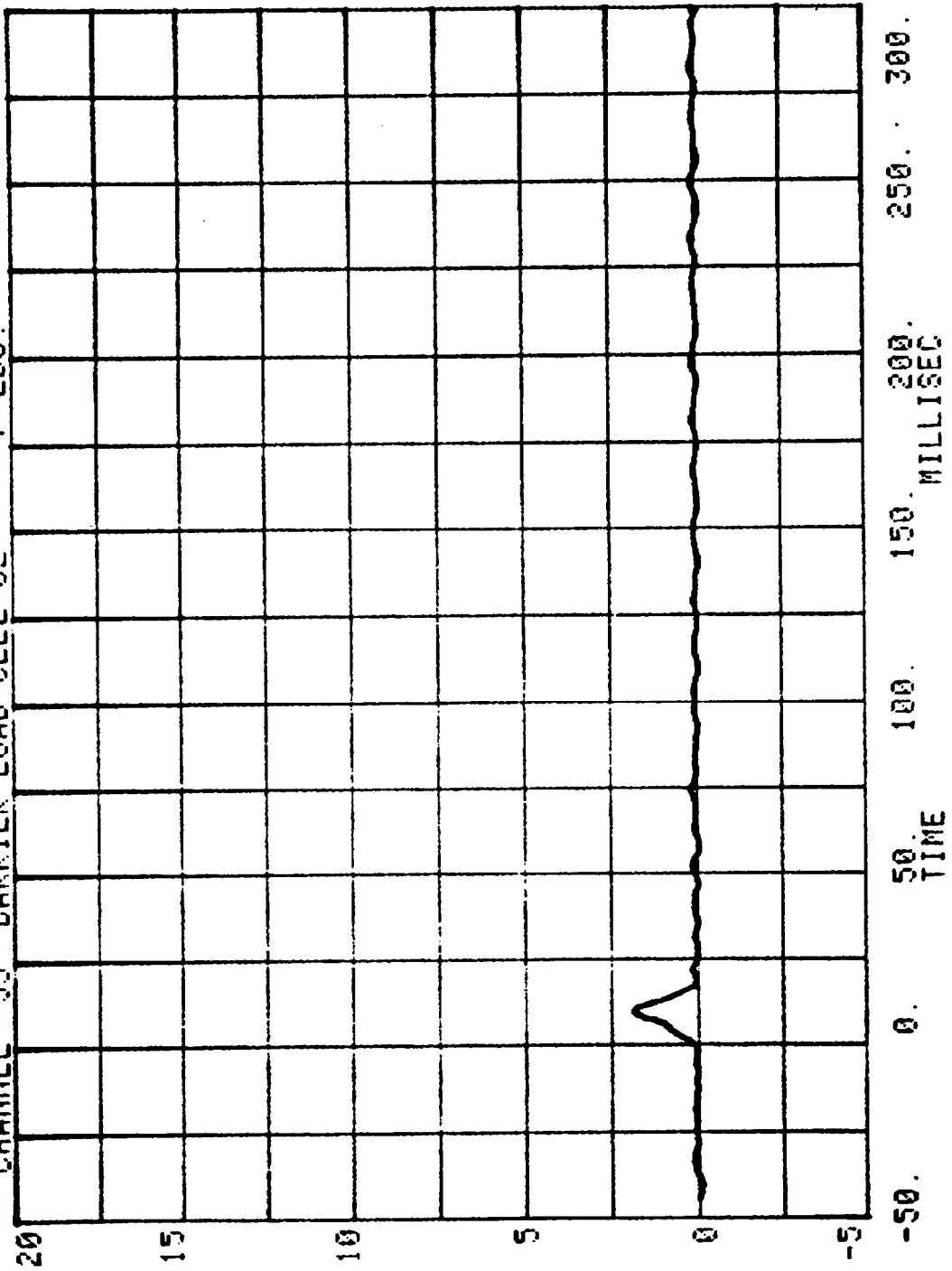


CHANNEL 52    RUN= 941    SERIES= 5101    K LBS.



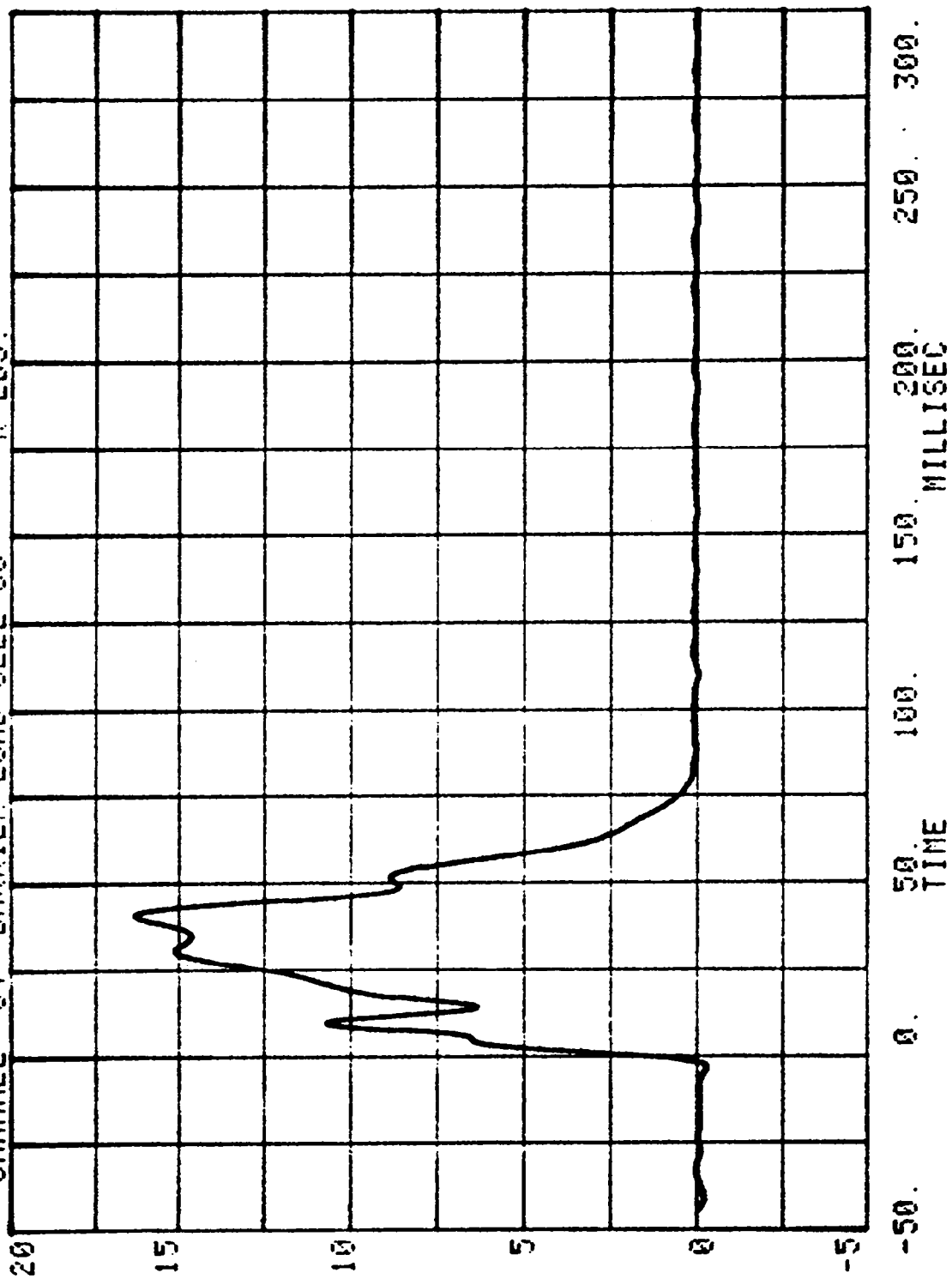
CHANNEL 53 BARRIER LOAD CELL C2 Y LBS.

RUN= 941 SERIES= 5101



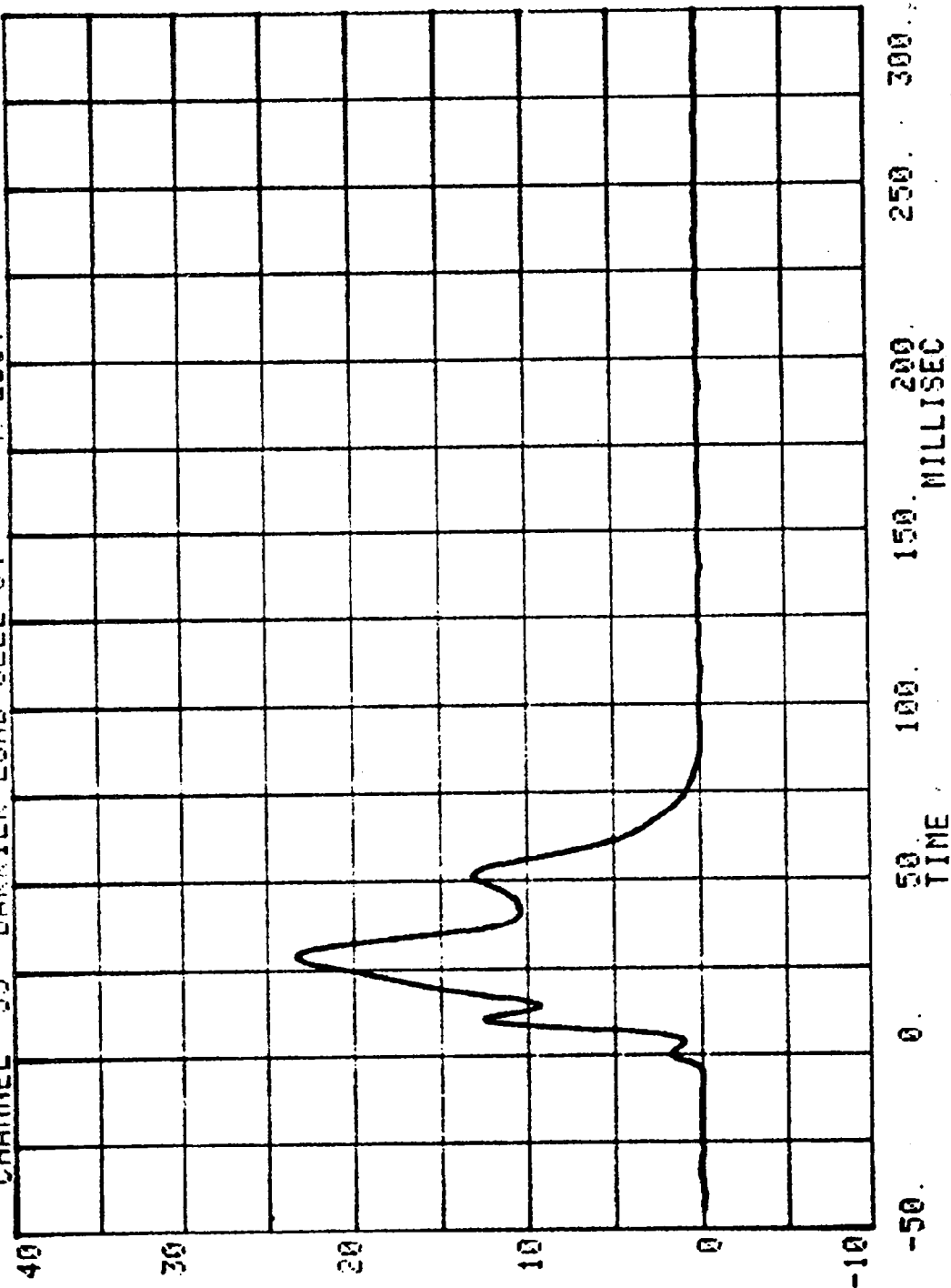
CHANNEL 54 BARrier LOAD CELL C3 K LBS.

RUN= 941 SERIES= 5101

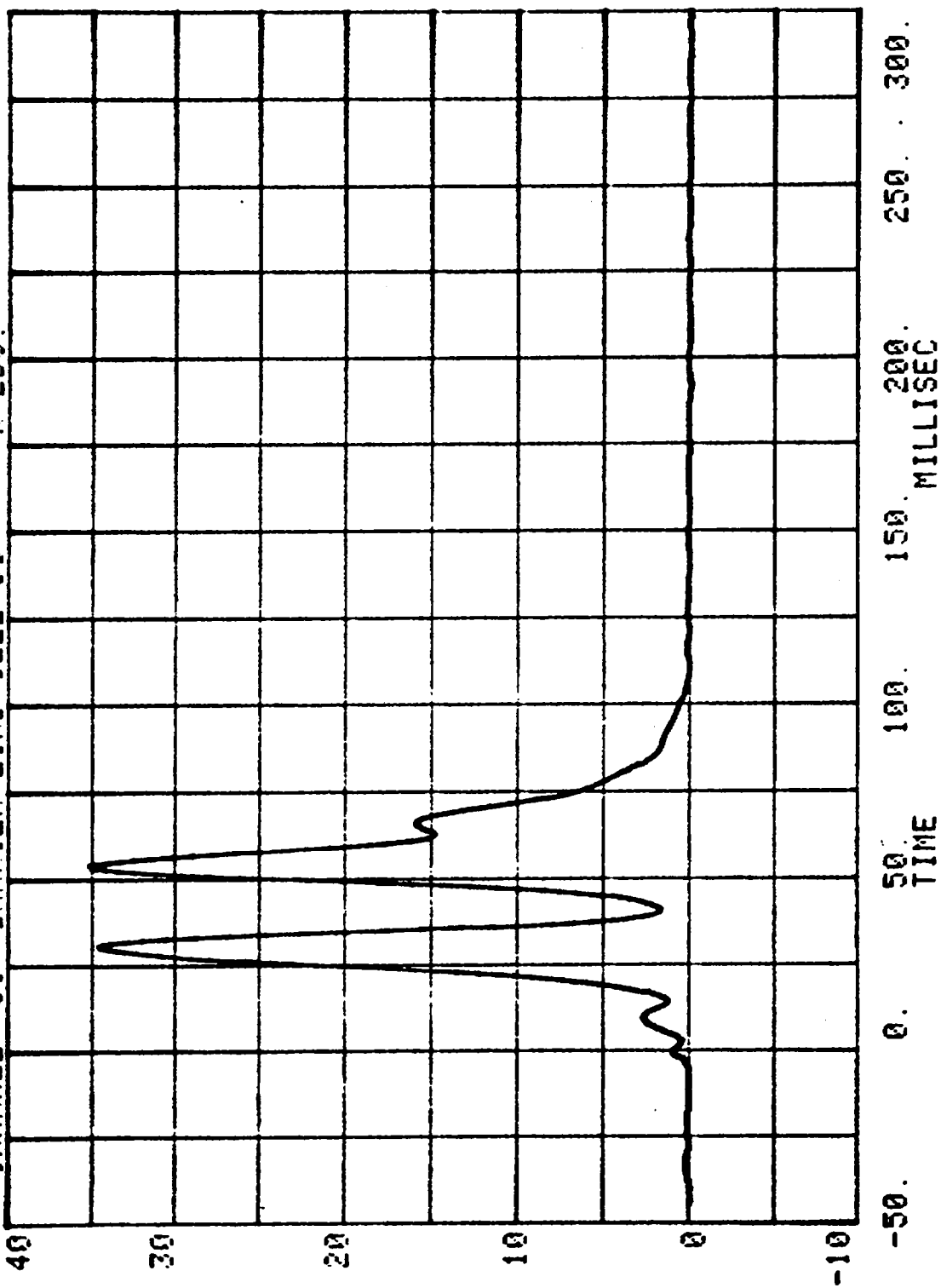


CHANNEL 55 BARRIER LOAD CELL C4 K LBS.

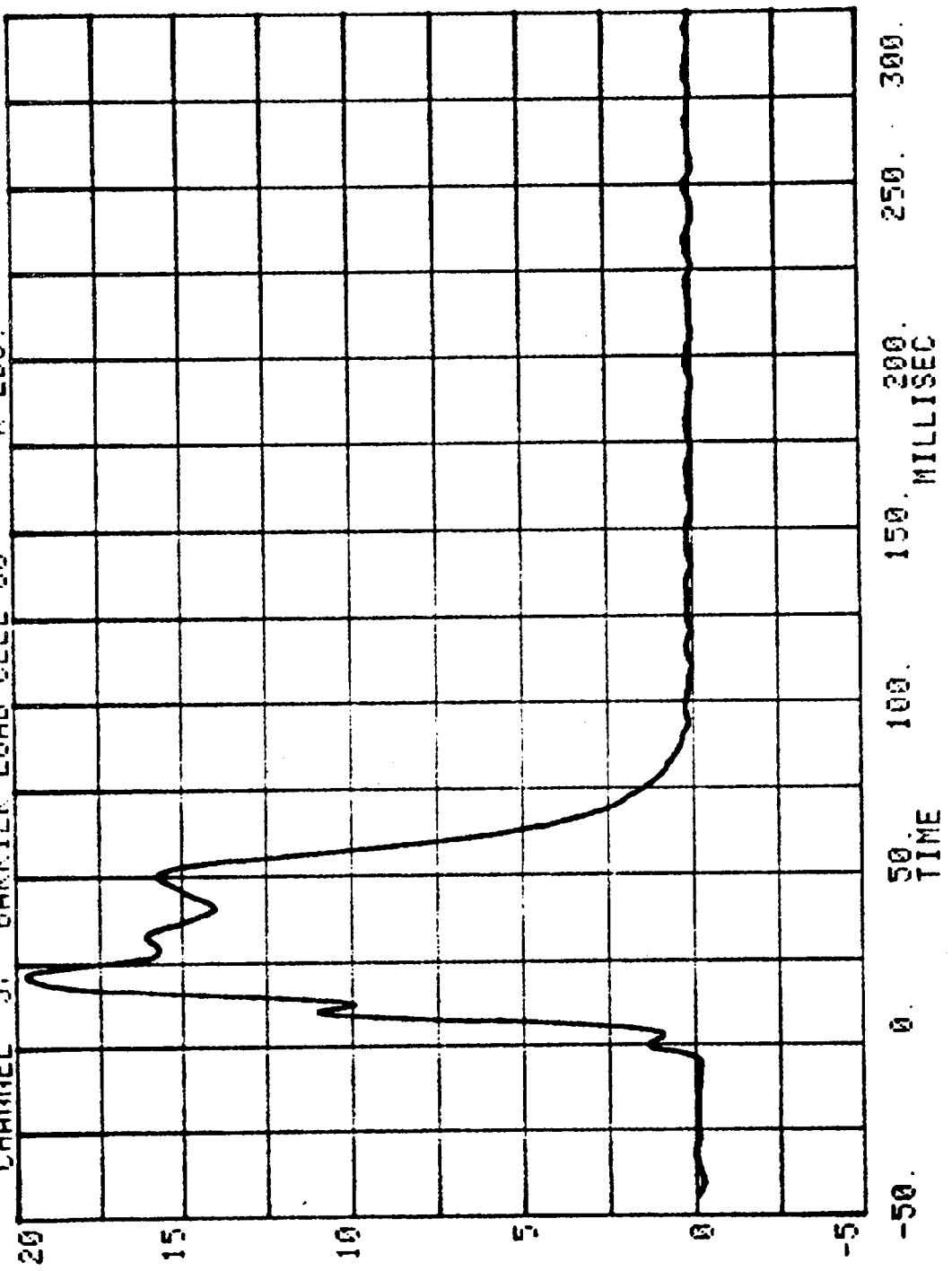
RUN= 341 SERIES= 5101



CHANNEL 56 BARRIER LOAD CELL C5 K LBS.  
RUN= 941 SERIES= 5101



CHANNEL 57 FUN= 341 SERIES= 5101 K LBS.  
BARRIER LOAD CELL 06



# NEW CAR ASSESSMENT PROGRAM - 1990

RUN # 941

SERIES # 5101

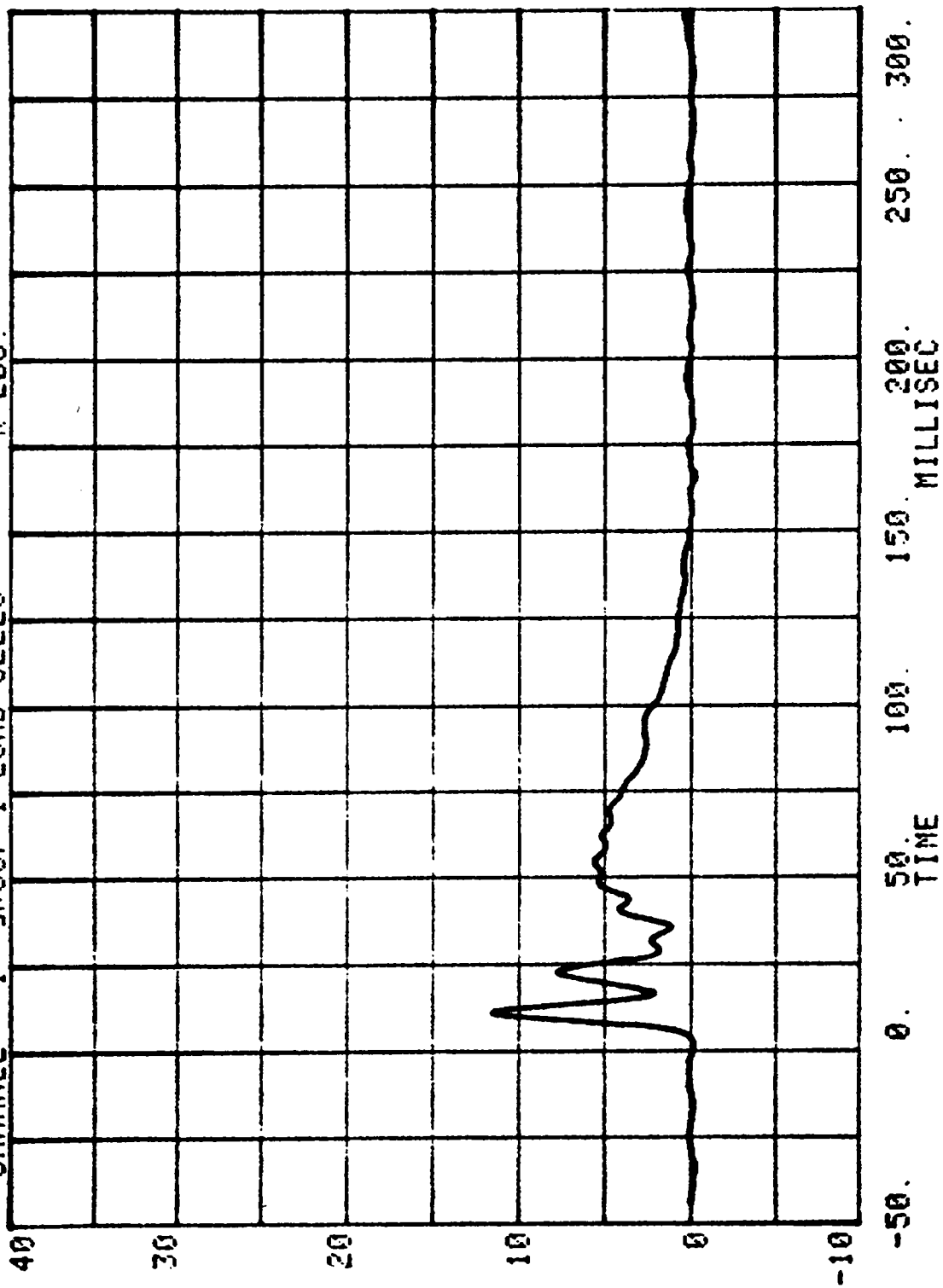
| CHAN | TITLE              | MINIMUM/MAXIMUM                | AT | TIME                    |
|------|--------------------|--------------------------------|----|-------------------------|
| 1    | GROUP 1 LOAD CELLS | - .237 K LBS.<br>11.536 K LBS. |    | 165.83 MS.<br>11.25 MS. |
| 2    | GROUP 2 LOAD CELLS | - .733 K LBS.<br>99.677 K LBS. |    | 1.65 MS.<br>12.60 MS.   |
| 3    | GROUP 3 LOAD CELLS | - .931 K LBS.<br>6.787 K LBS.  |    | -32.62 MS.<br>41.40 MS. |

# NEW CAR ASSESSMENT PROGRAM - 1990

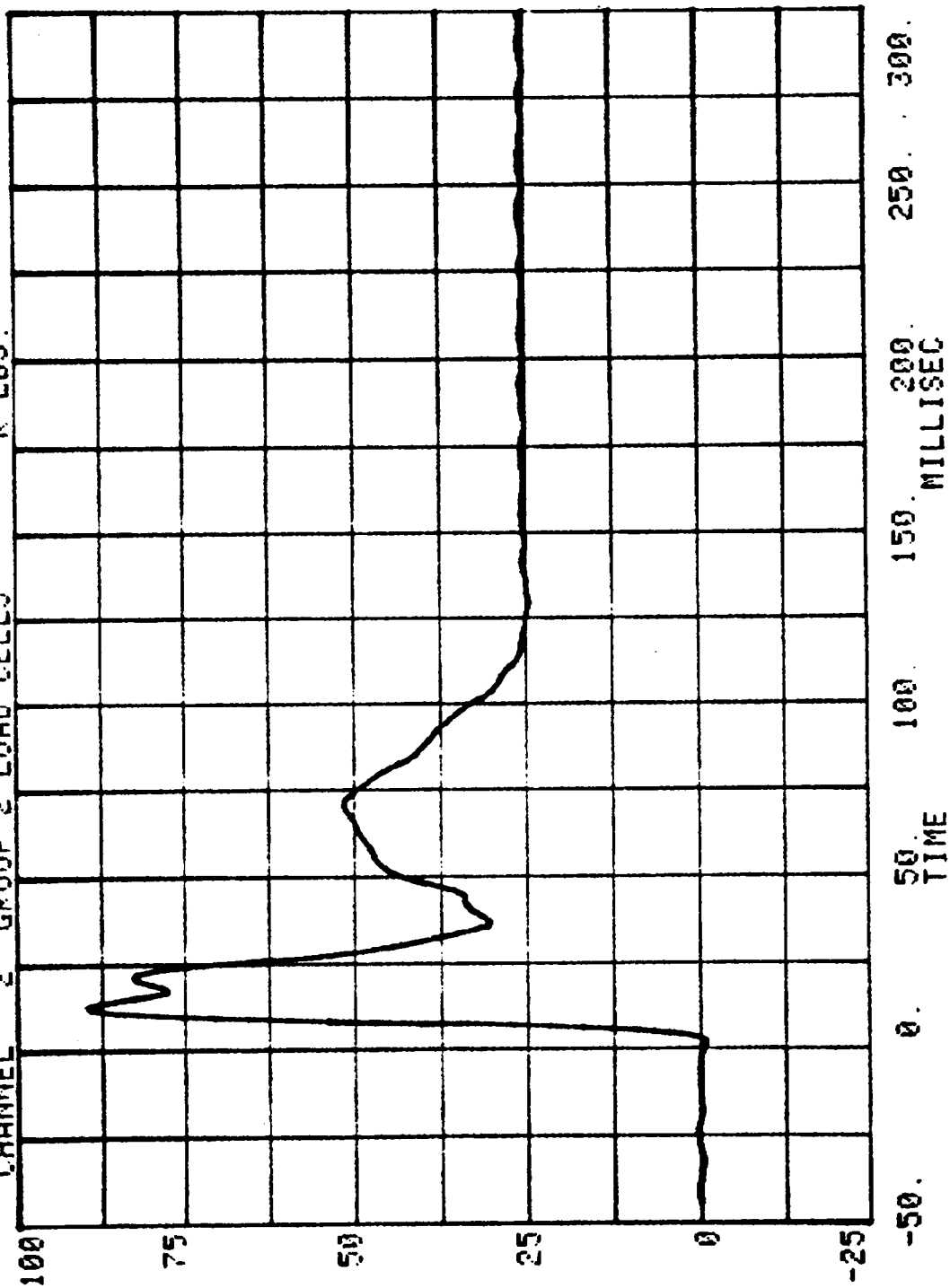
|    |       |          |                 |    |           |
|----|-------|----------|-----------------|----|-----------|
| CH | RUN # | SERIES # | MINIMUM/MAXIMUM | AT | TIME      |
| 10 | 941   | 5101     | - 825 K LBS.    |    | 1.27 MS.  |
|    |       |          | 102.525 K LBS.  |    | 11.92 MS. |

TITLE  
SUM OF GROUPS 1,2,3

CHANNEL 1 GROUP 1 LOAD CELLS RUN= 941 SERIES= 5101 K LBS.

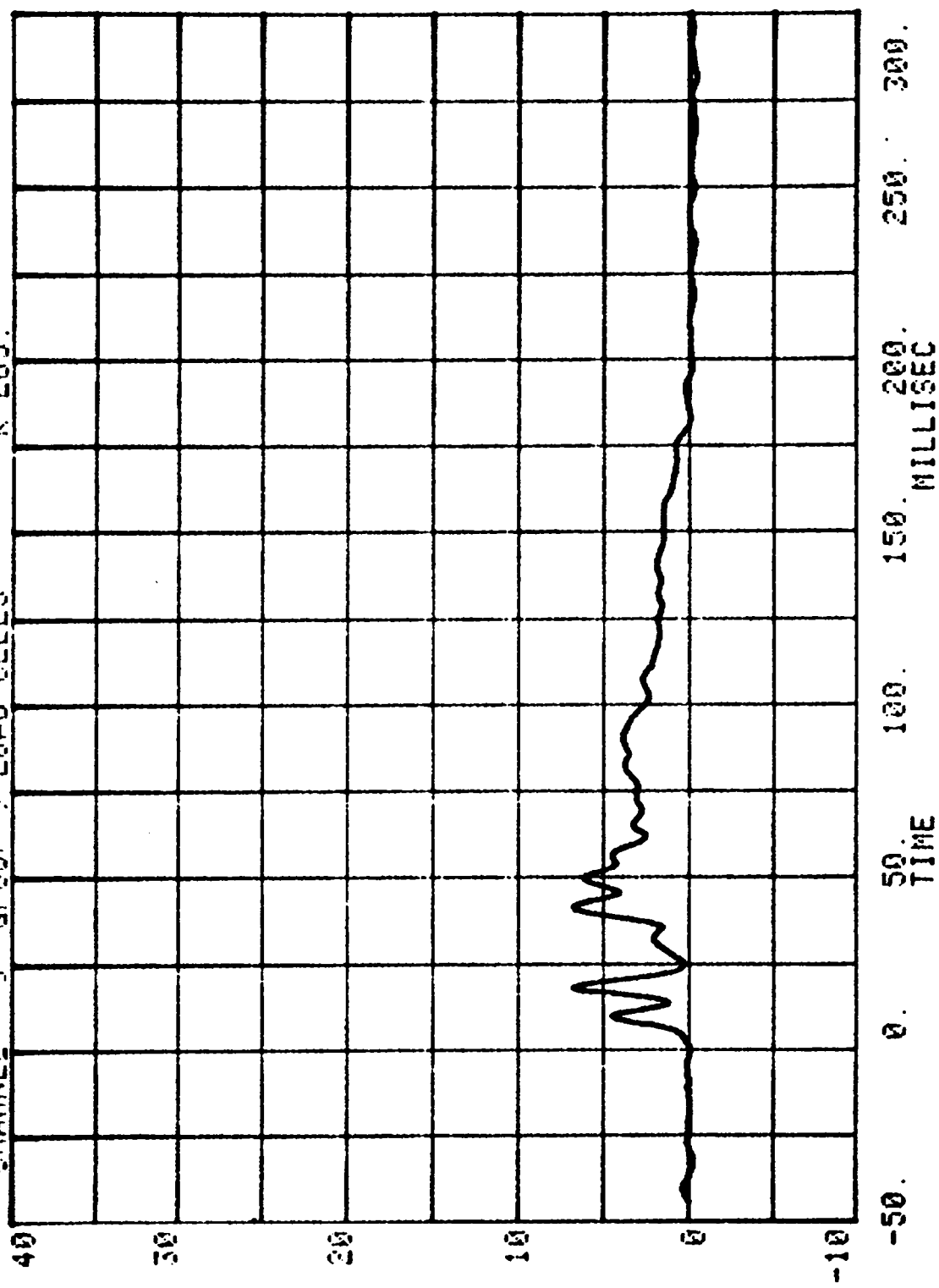


CHANNEL 2 GROUP 2 LOAD CELLS  
RUN= 941 SERIES= 5101 K LBS.

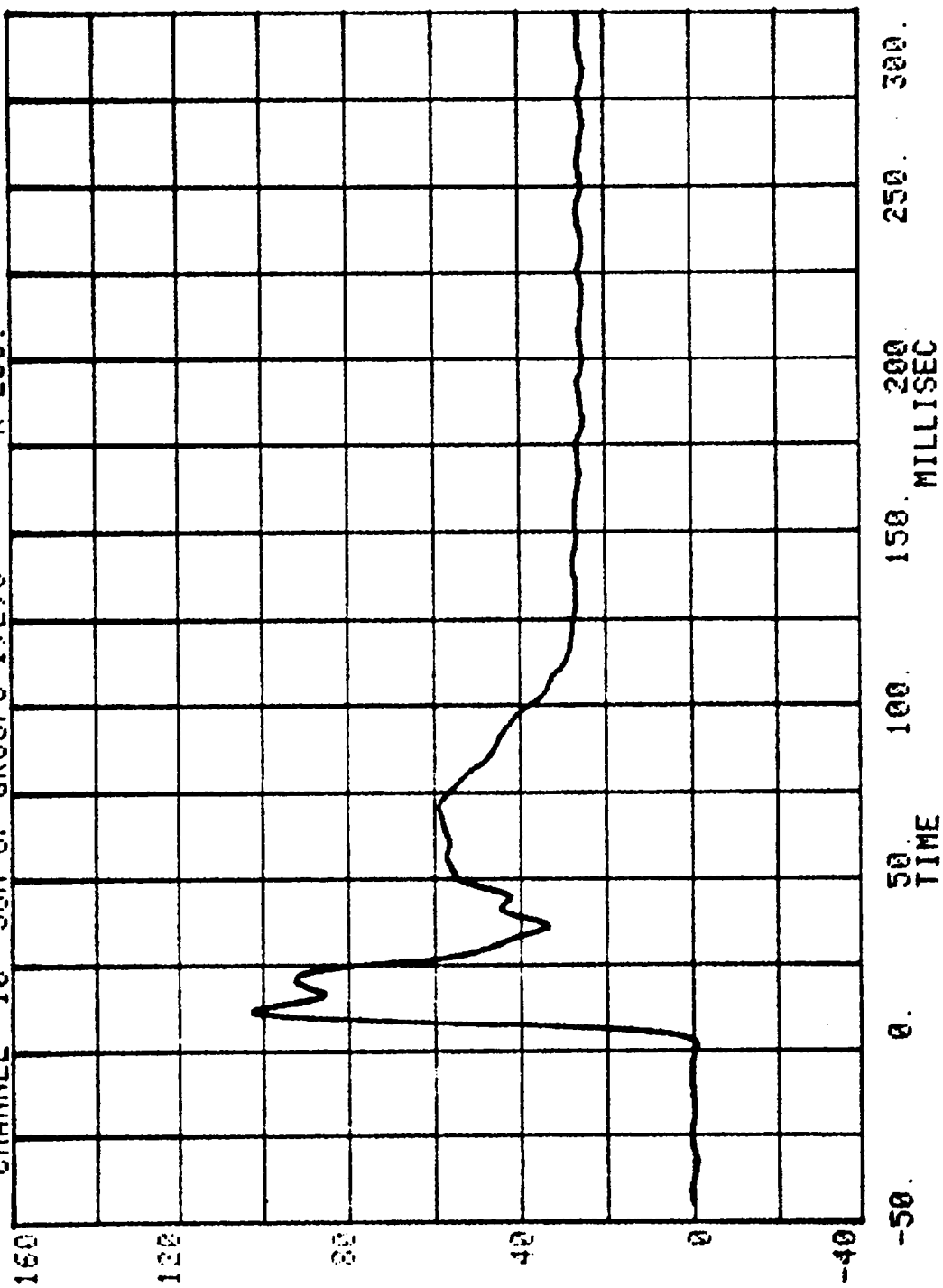


CHANNEL 3 GROUP 3 LOAD CELLS K LBS.

RUN= 941 SERIES= 5101



RUN= 941 SERIES= 5101 K LBS.  
CHANNEL 10 SUM OF GROUPS 1,2,3



TEST NO. ML5101

DUMMY DATA

| CLASS               | FILTER CHANNEL |
|---------------------|----------------|
| Head Accelerations  | 1000           |
| Chest Accelerations | 180            |
| Femur Forces        | 600            |
| Belt Loads          | 60             |

HEAD INJURY CRITERION  
HEAD SEVERITY INDEX  
36MS. MAXIMUM DURATION

NEW CAR ASSESSMENT PROGRAM - 1990

RUN= 941

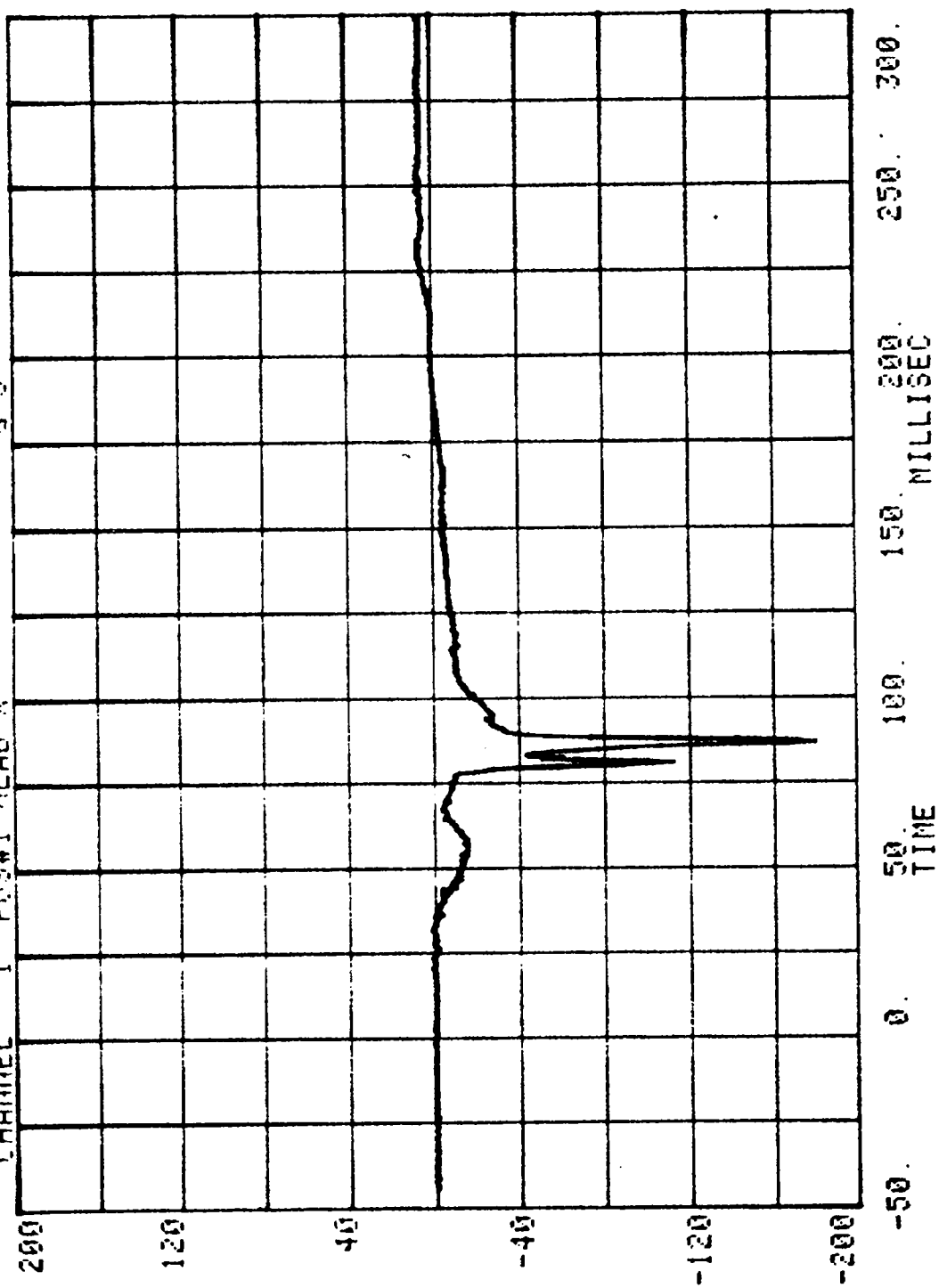
POS#1 HEAD R

HIC=1305.6 FROM T1= .05745 TO T2= .09165  
AVERAGE ACCELERATION BETWEEN T1 AND T2= 59 GC'S  
EVENT TIME= 300.0 MSEC  
SEVERITY INDEX=2000.7

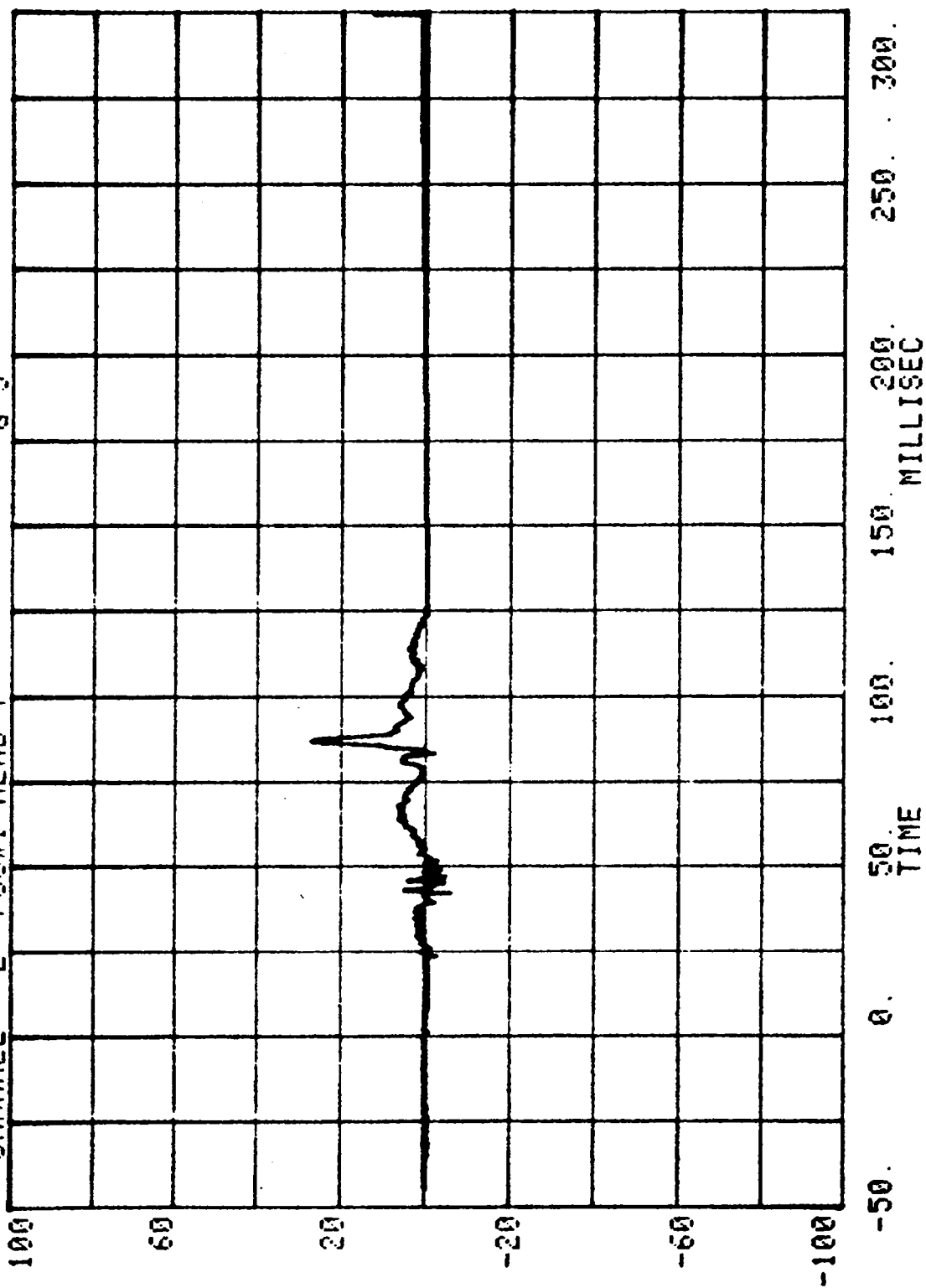
NEW CAR ASSESSMENT PROGRAM - 1990

| CHANNEL | RUN # | TITLE   | SERIES # | 3 MS | CLIPPED | PEAK       |
|---------|-------|---------|----------|------|---------|------------|
| 2       | POS#1 | CHEST R | 5101     |      |         | 47.566 G'S |
| 4       | POS#2 | CHEST R |          |      |         | 47.192 G'S |

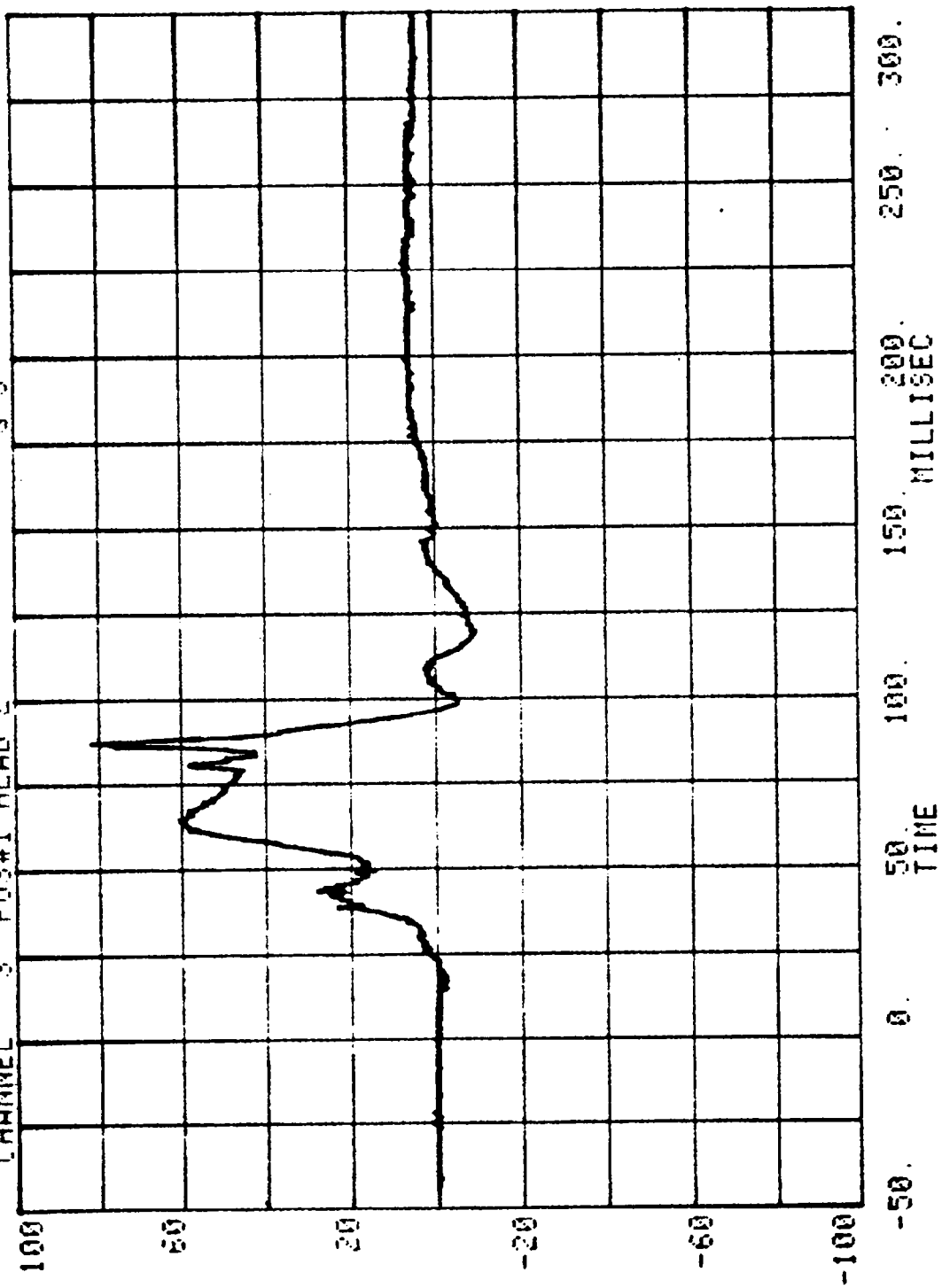
CHANNEL 1 POS#1 HEAD W RUN= 941 SERIES= 5101 G'S



CHANNEL 2 POS#1 HEAD Y RUN= 941 SERIES= 5101 G'S

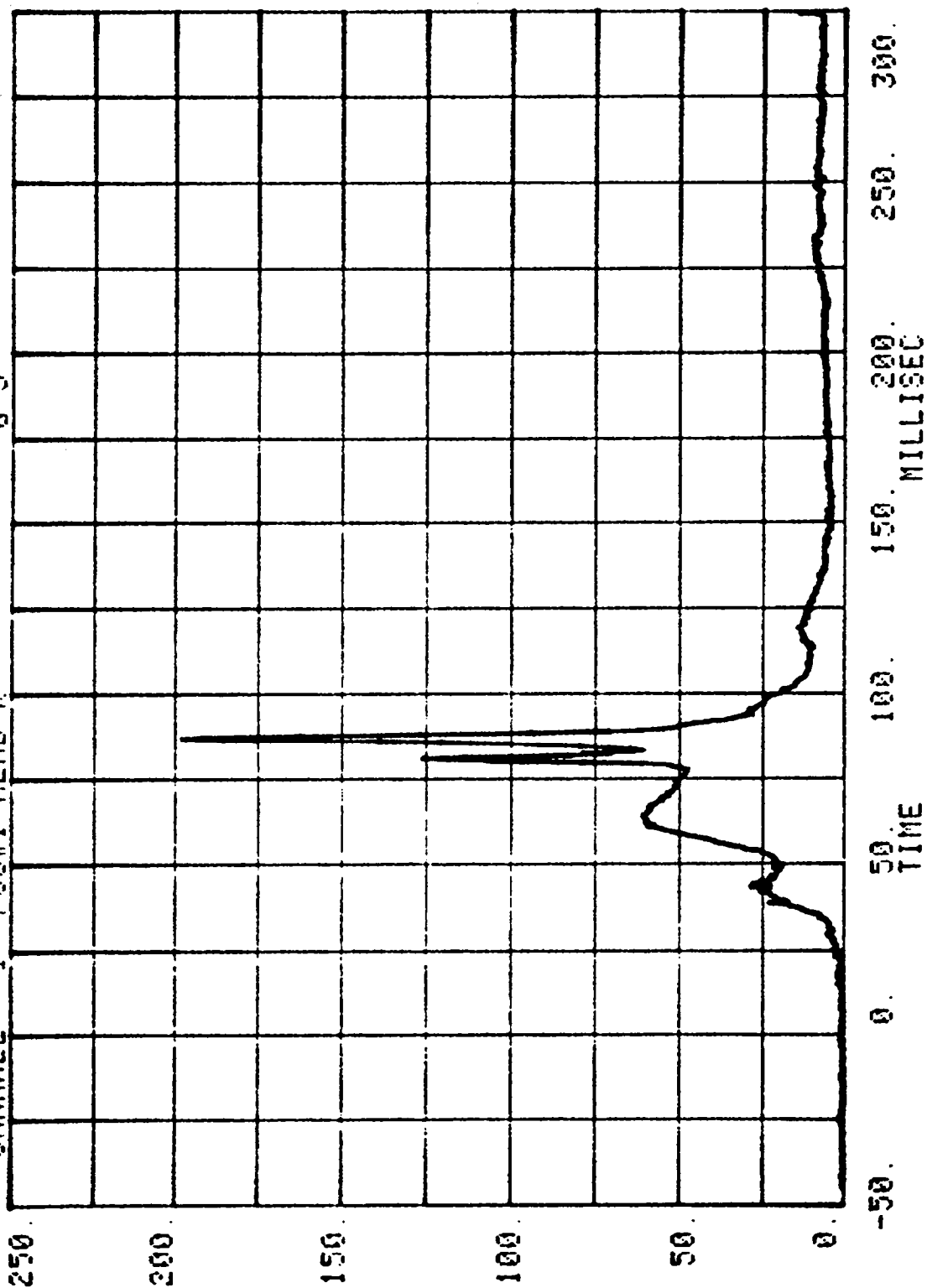


CHANNEL 3 POS#1 HEAD 2 RUN= 941 SERIES= 5101 G'S

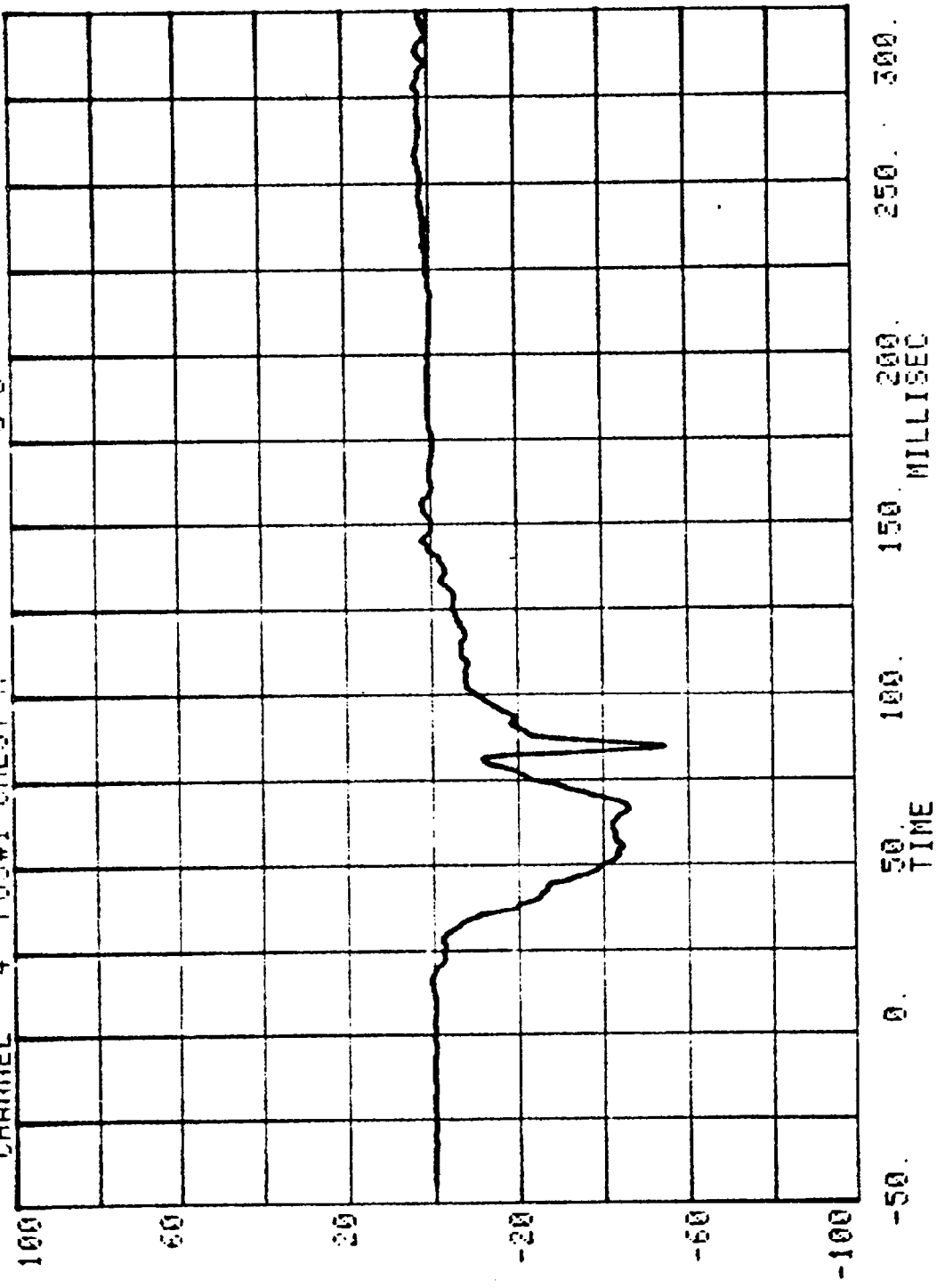


CHANNEL 1 RUN= 941 SERIES= 5101 G'S

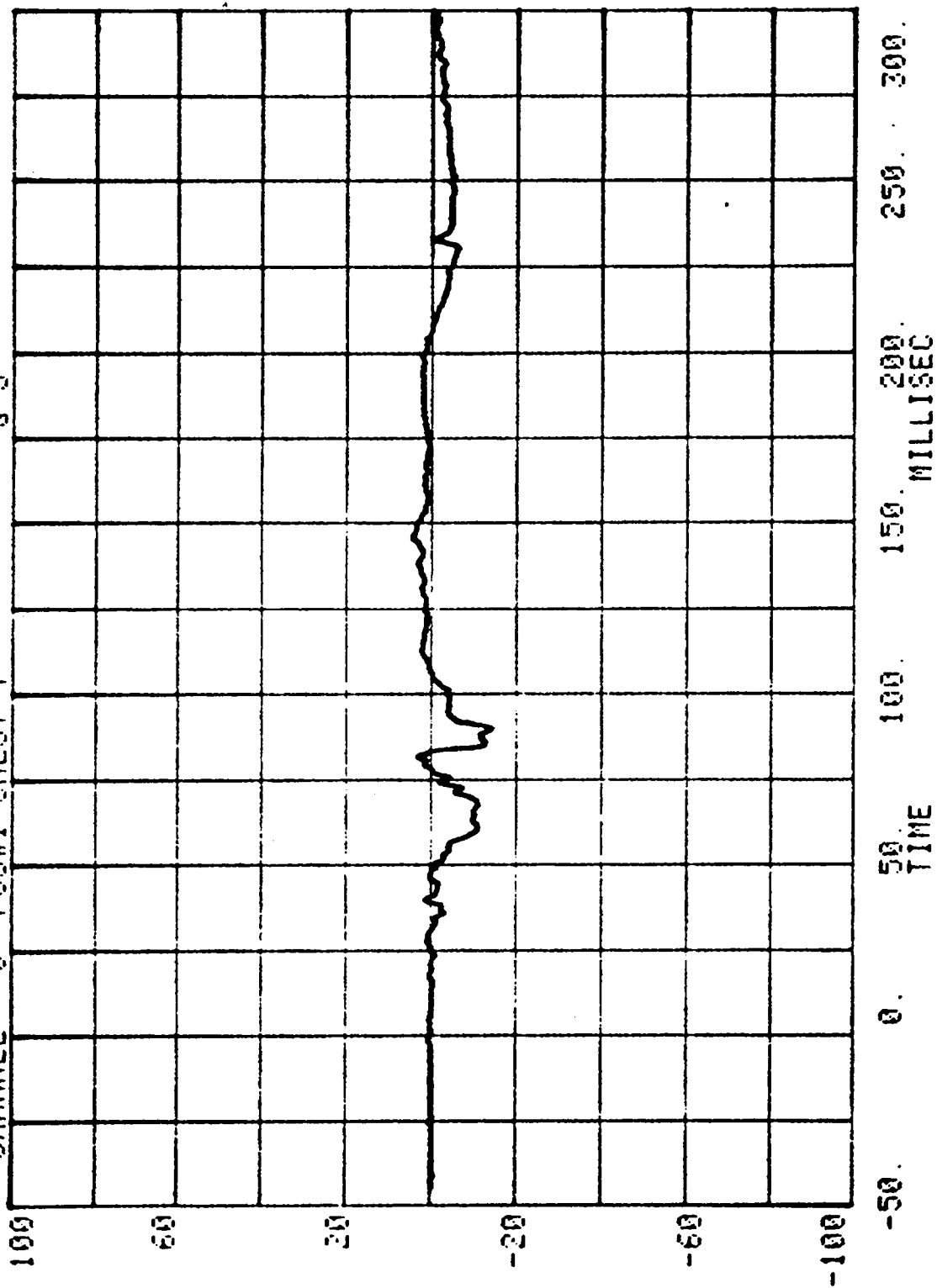
POS#1 HEAD R



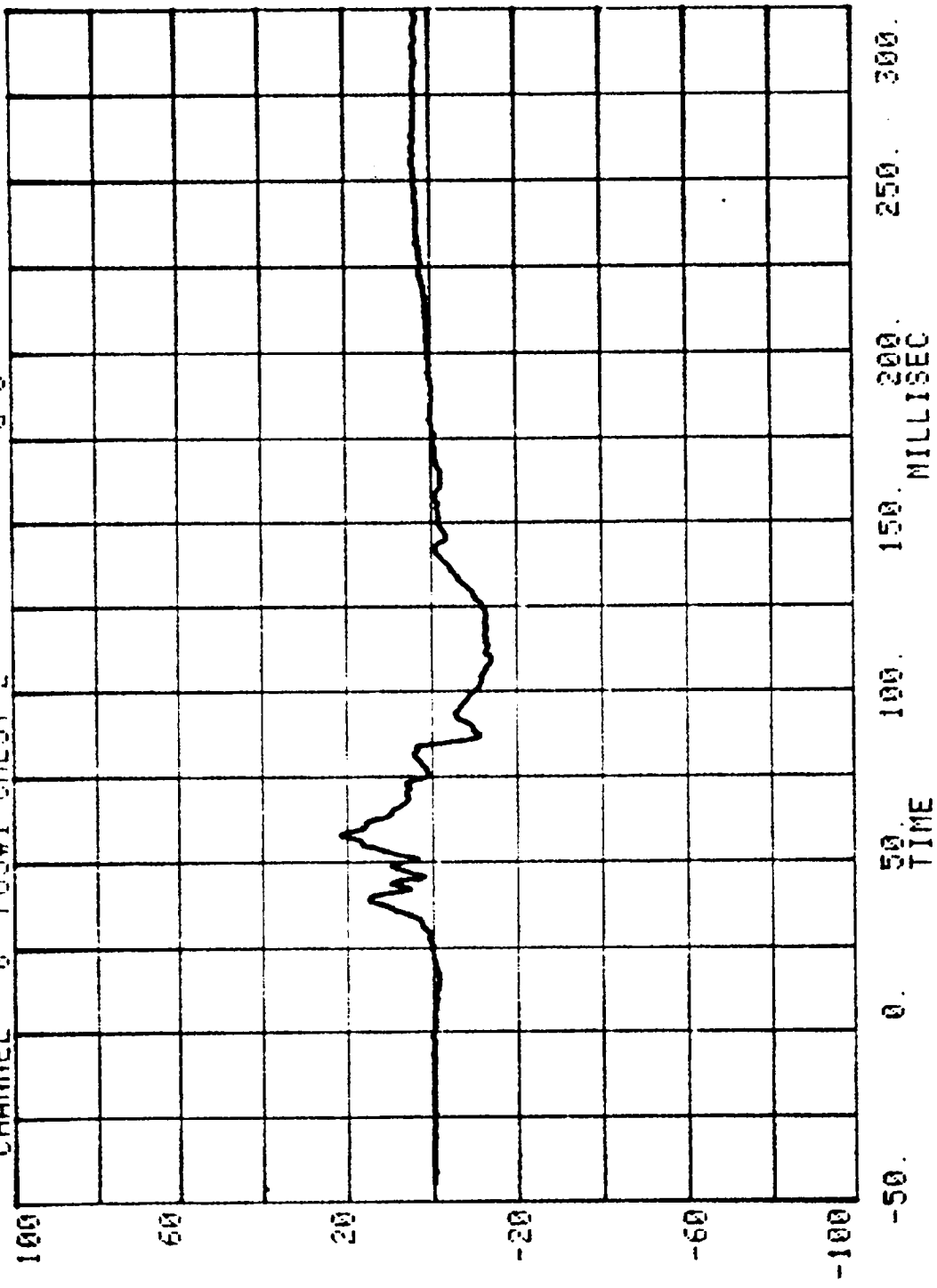
CHANNEL 4 POS#1 CHEST X RUN= 941 SERIES= 5101 G'S



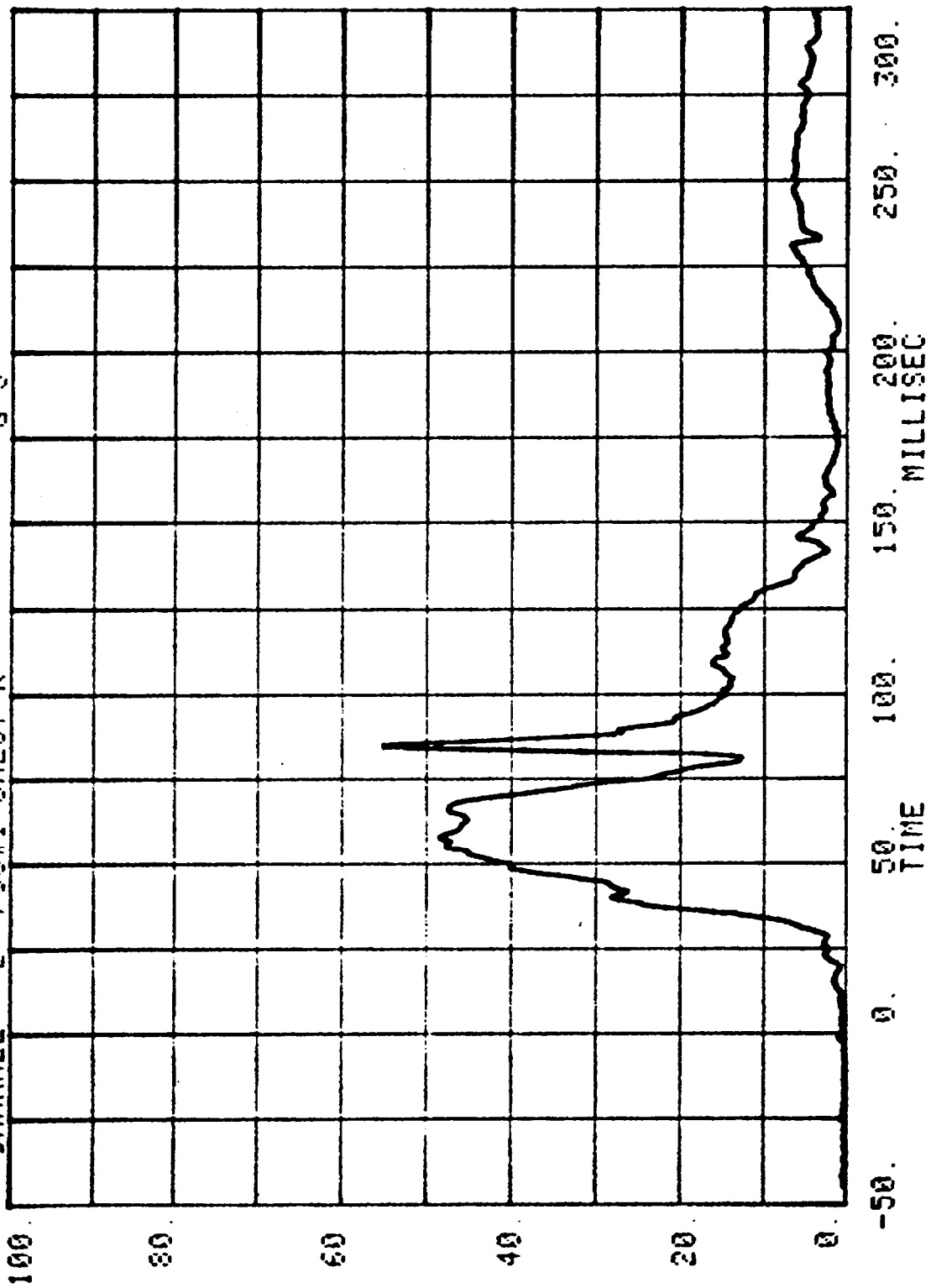
CHANNEL 5 POS#1 CHEST 7  
FUN# 941 SERIES= 5101 G'S



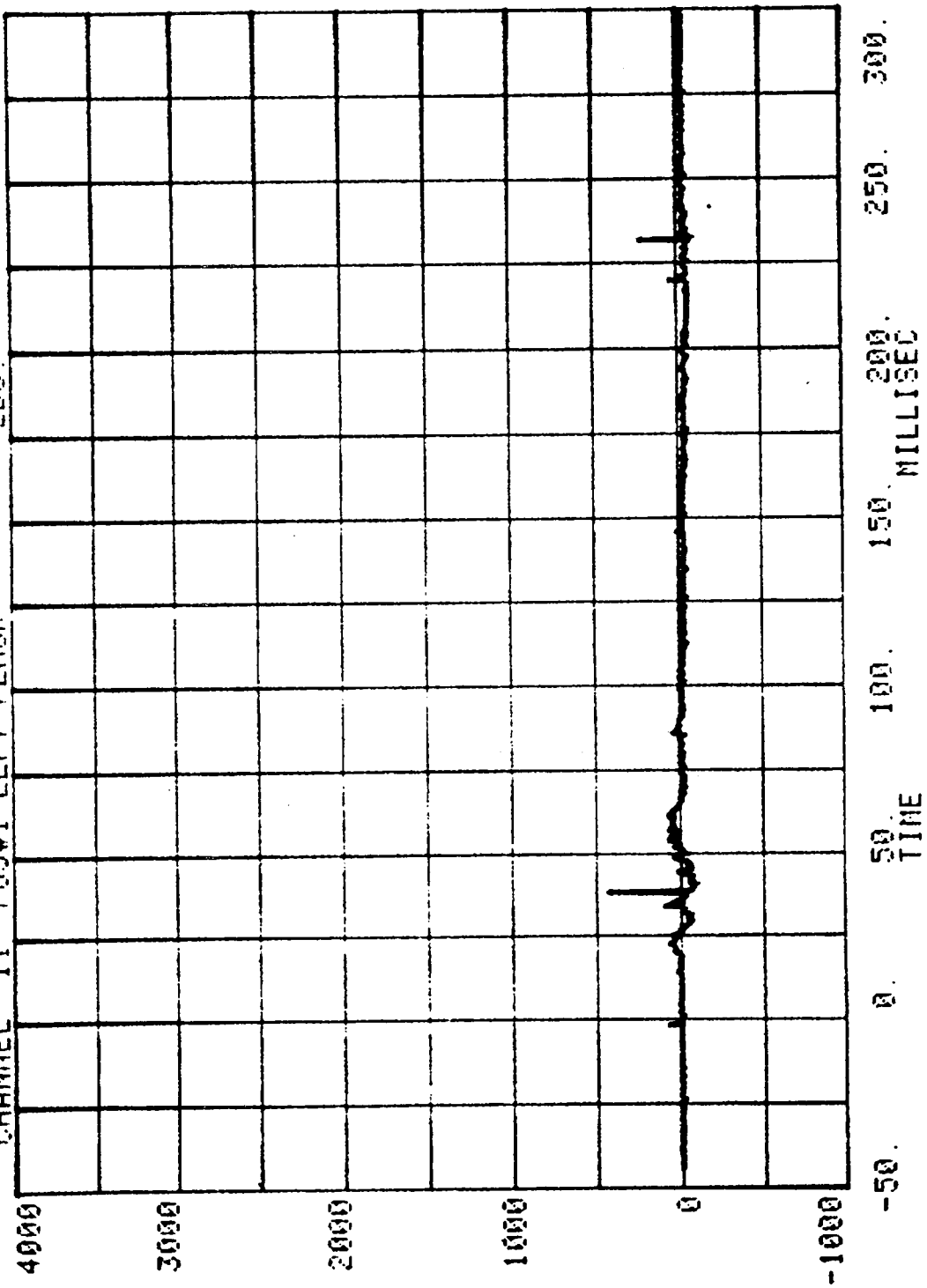
CHANNEL 6 POS#1 CHEST 2  
RUN= 241 SERIES= 5101 G'S



CHANNEL 2 RUN= 941 SERIES= 5101  
POS#1 CHEST R G'S



CHANNEL 11 POS#1 LEFT FEMUR  
RUN= 341 SERIES= 5101 LBS.

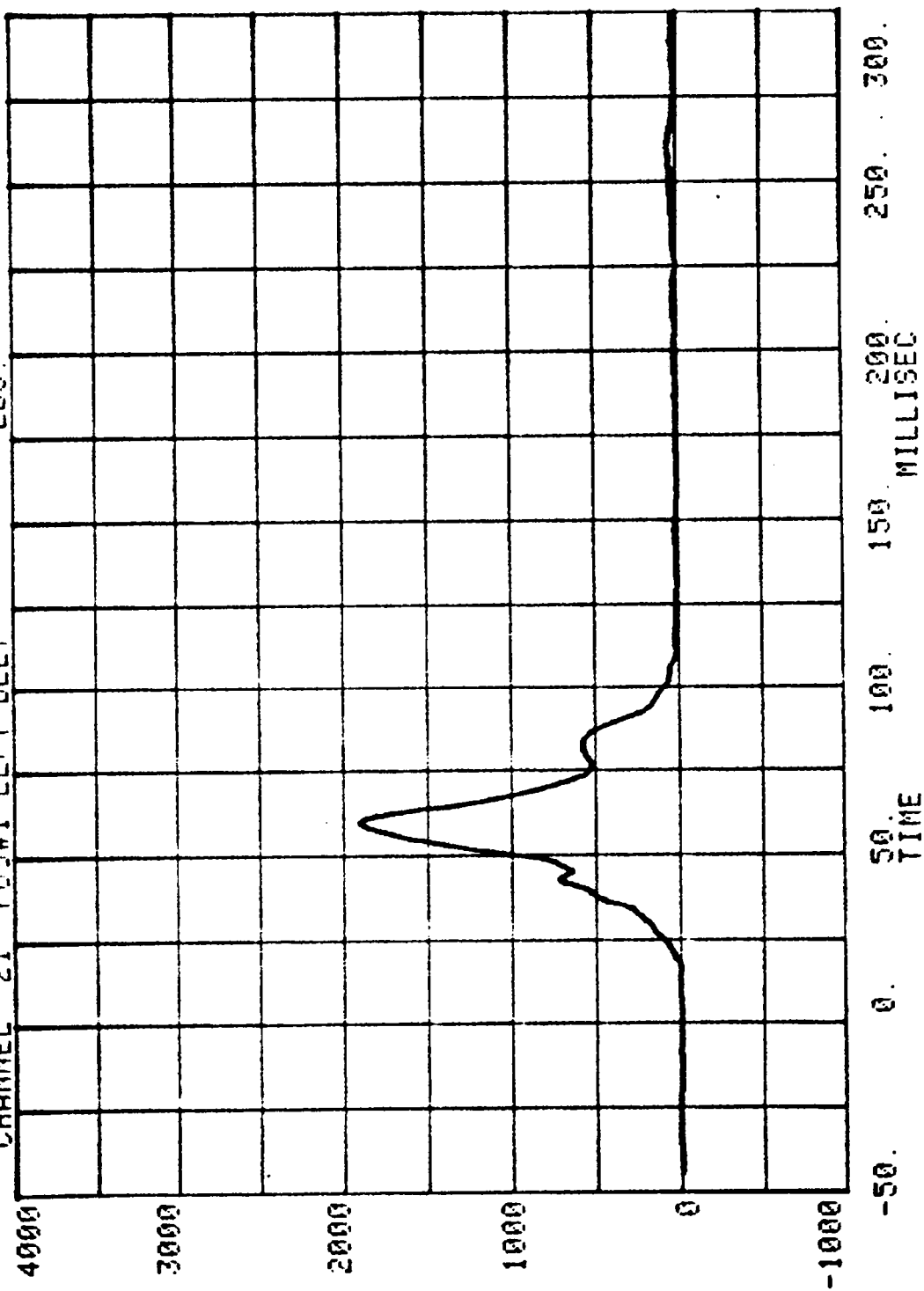


CHANNEL 12 POS#1 RIGHT FEMUR LBS.

RUN= 941 SERIES= 5101

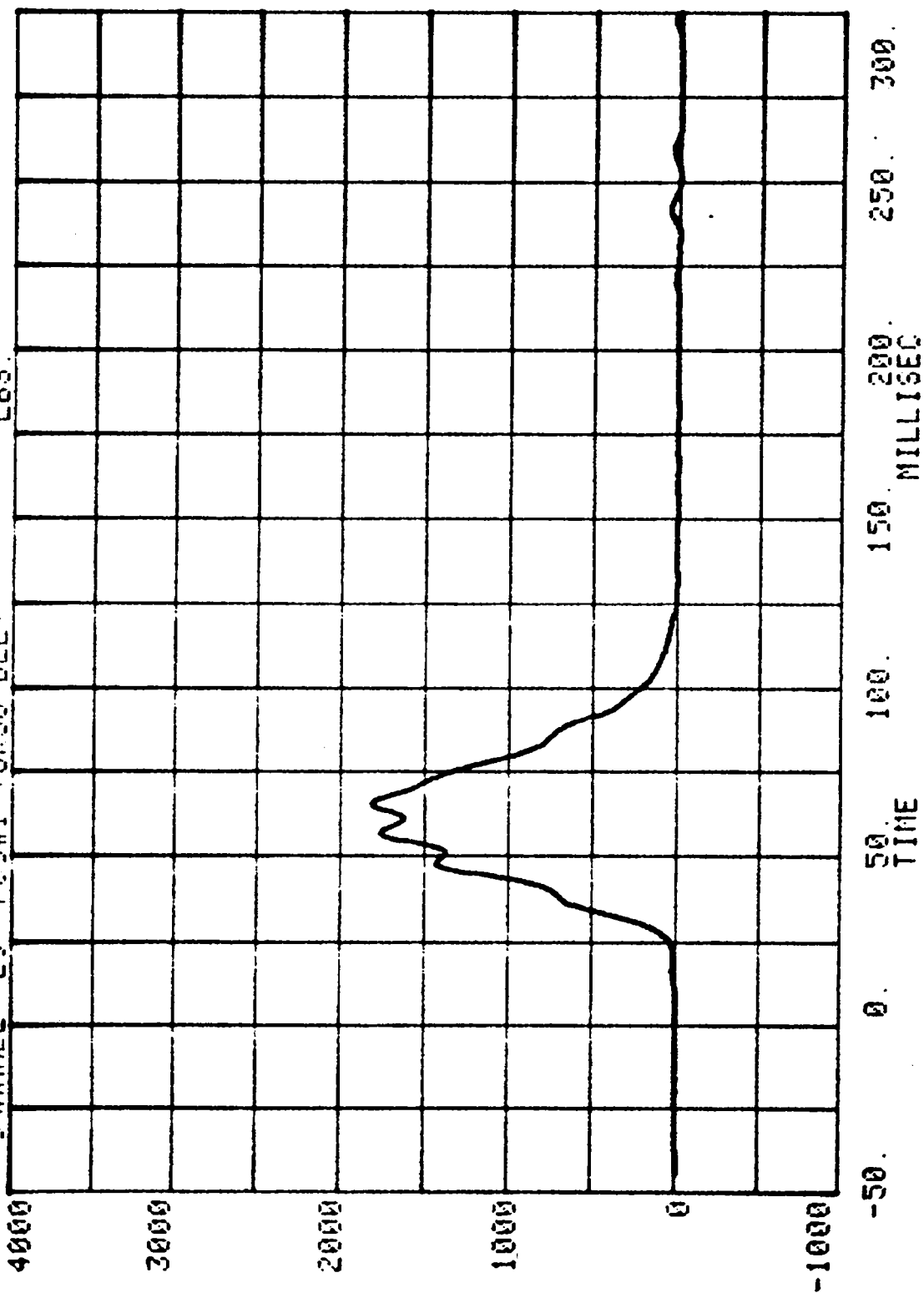


CHANNEL 21 POS#1 LEFT BELT  
RUN= 941 SERIES= 5101 LBS.



CHANNEL 23 POS#1 TORSO BELT LB3

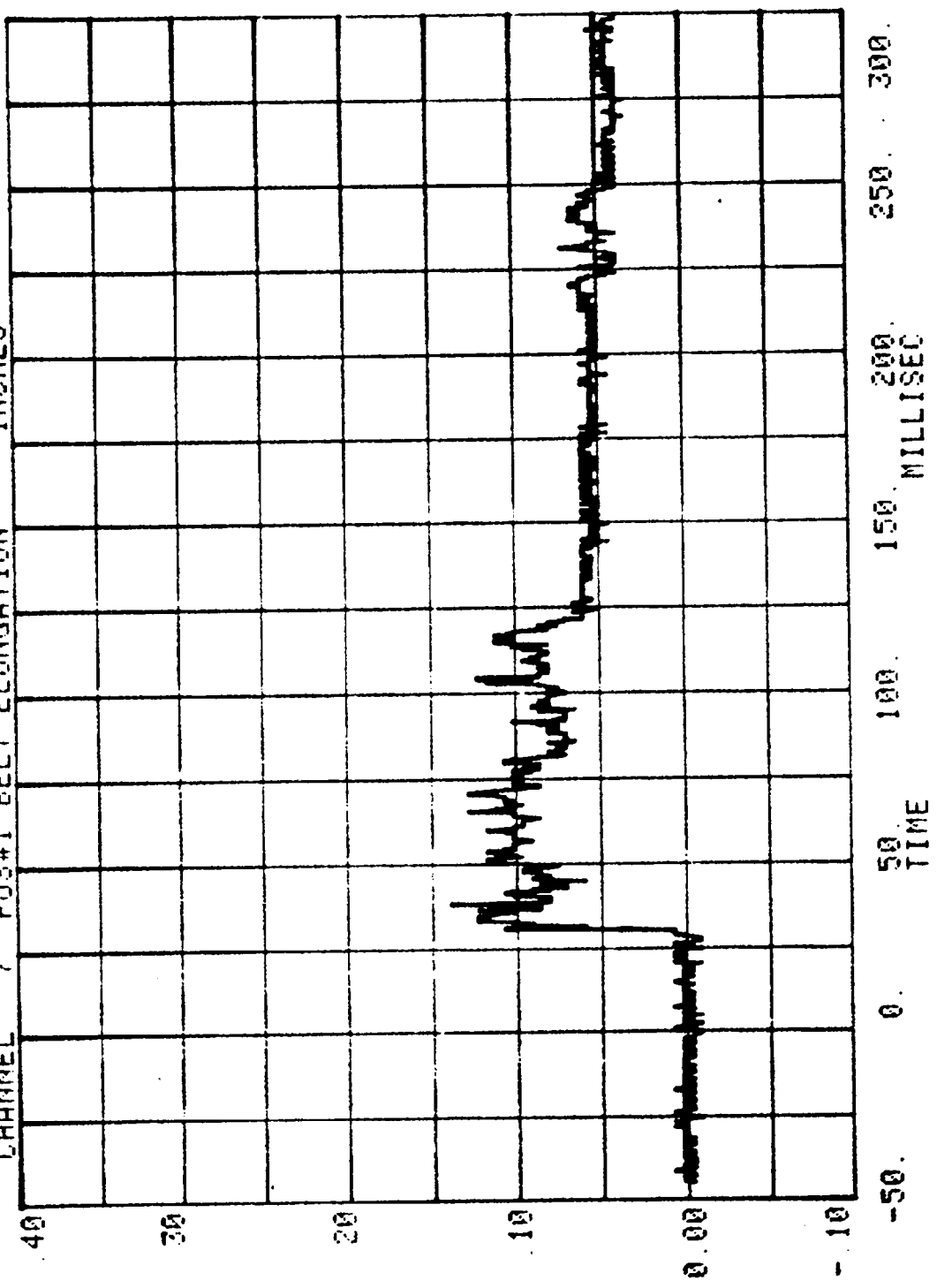
RUN= 341 SERIES= 5101



Measured over  
2.5 inches

CHANNEL 7 POS#1 BELT ELONGATION INCHES

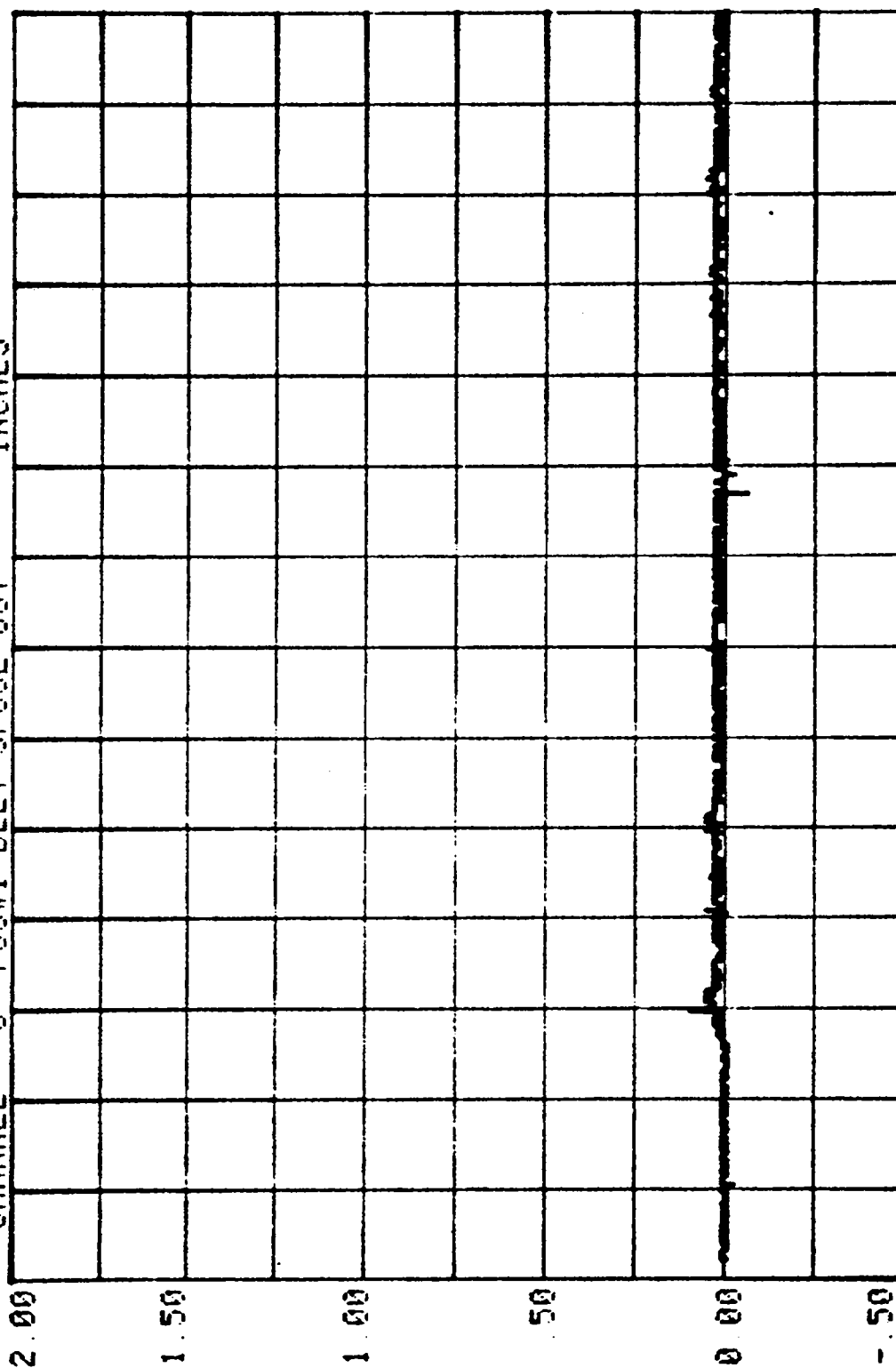
RUN= 941 SERIES= 5101



CHANNEL 8 POS#1 BELT SPOOL OUT

RUN= 941 SERIES= 5101

INCHES



-50. 0. 50. 100. 150. 200. 250. 300.  
TIME MILLISEC

HEAD INJURY CRITERION  
HEAD SEVERITY INDEX  
35MS. MAXIMUM DURATION

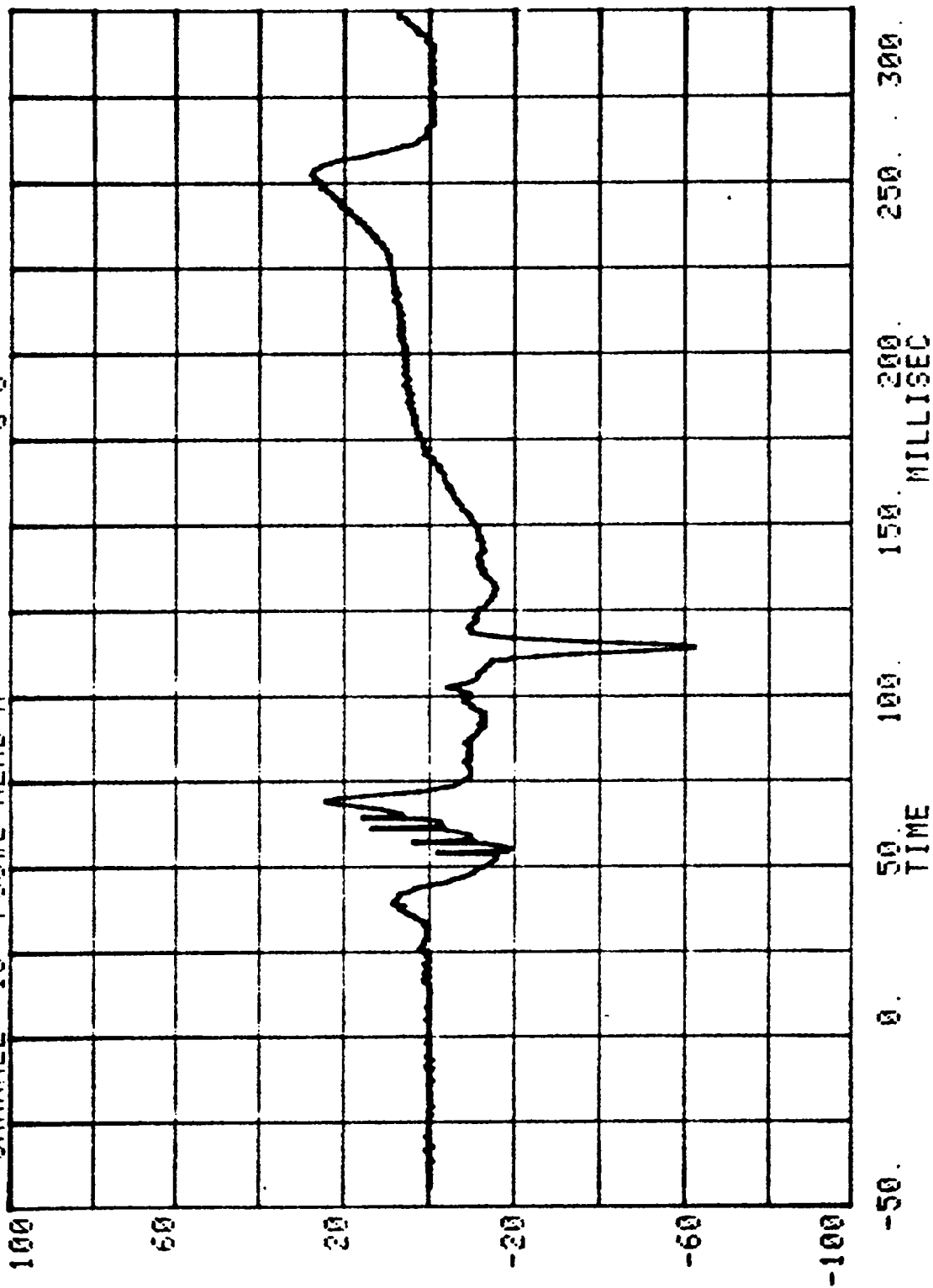
NEW CAR ASSESSMENT PROGRAM - 1990

RUN= 941

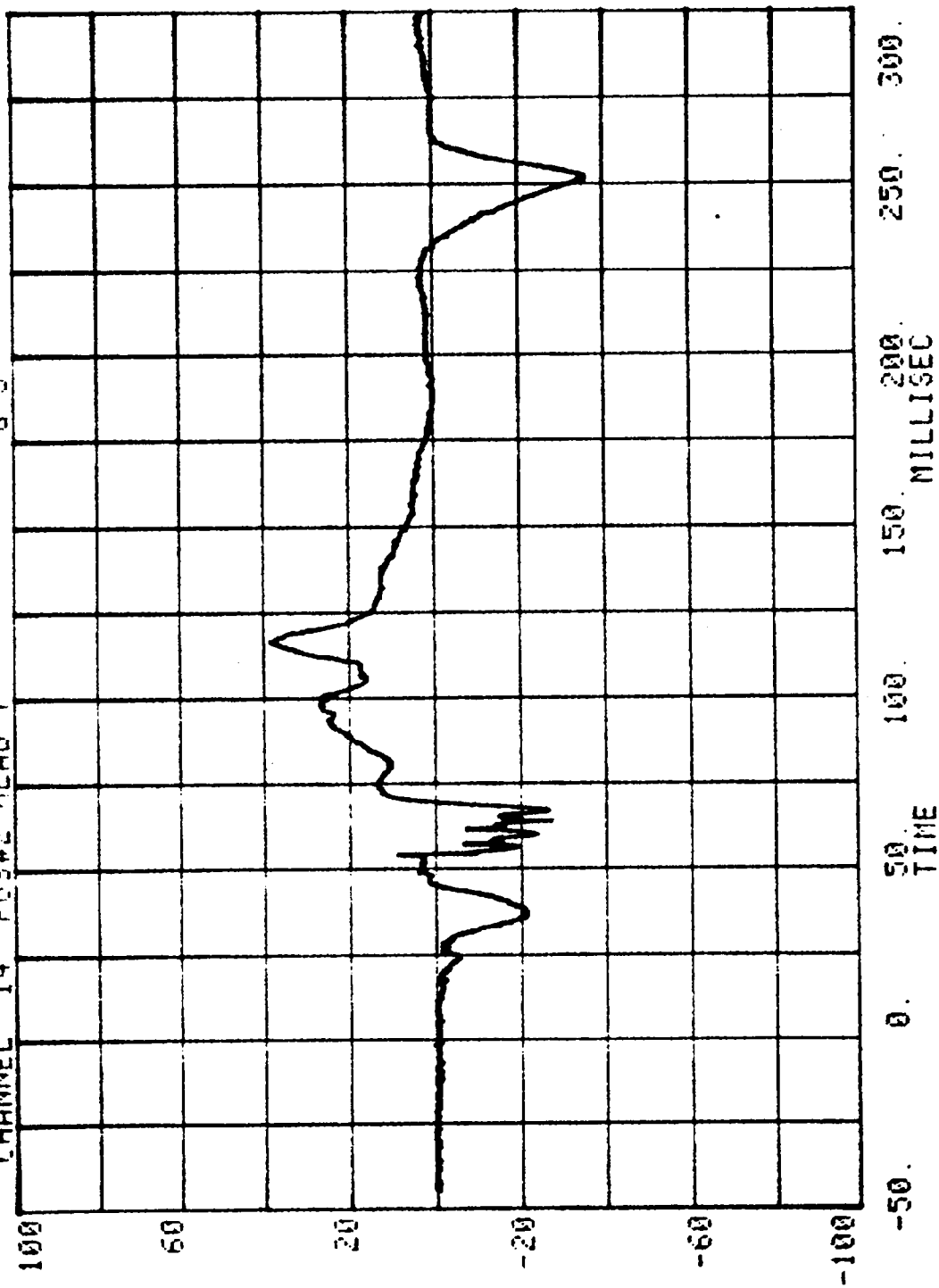
POS#2 HEAD R

HIC=1133.4 FROM T1= .05872 TO T2= .07830  
AVERAGE ACCELERATION BETWEEN T1 AND T2= 80.4G'S  
EVENT TIME= 300.0 MSEC  
SEVERITY INDEX=2301.0

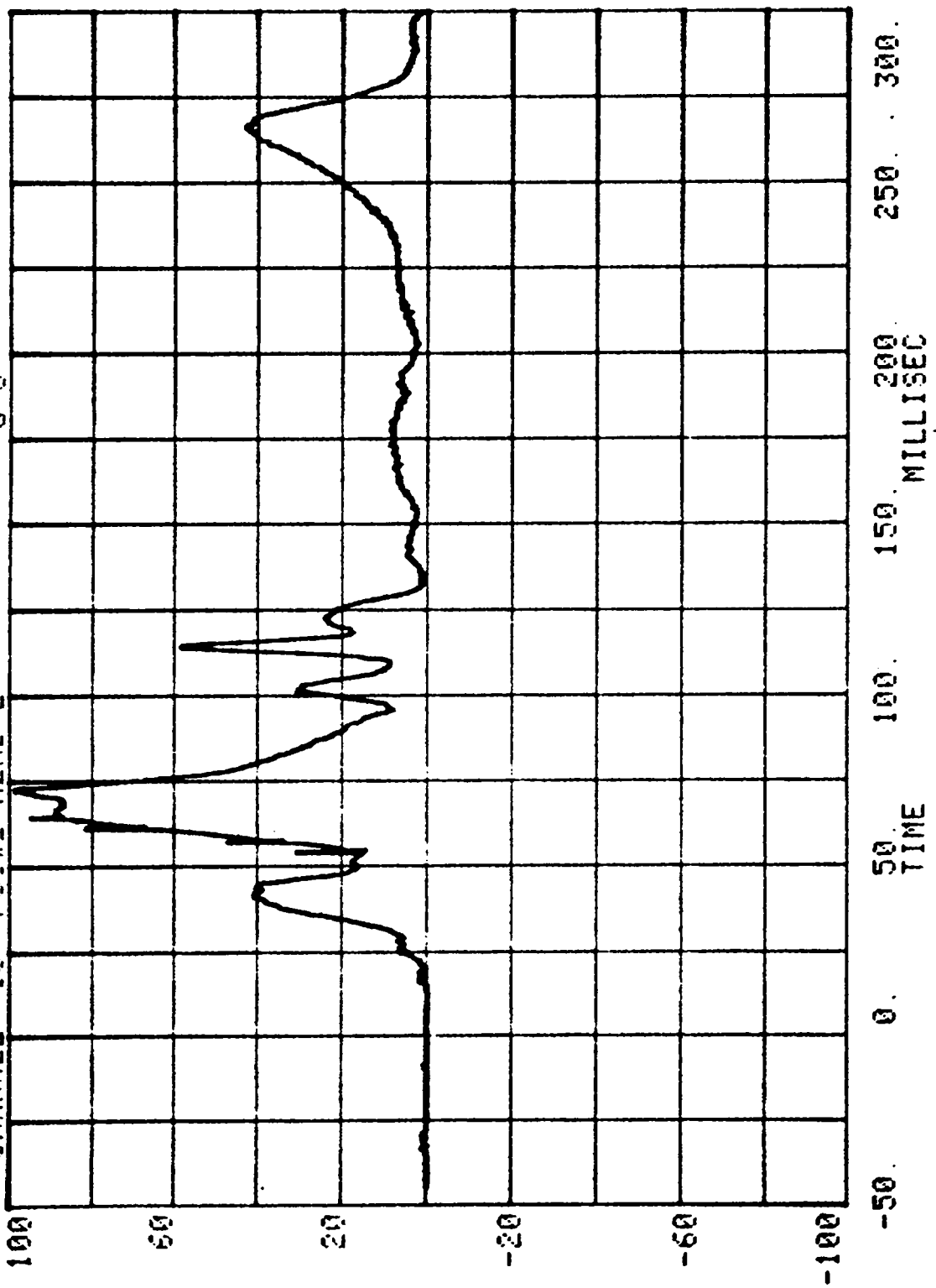
CHANNEL 13 POS#2 HEAD X  
RUN= 941 SERIES= 5101 G'S



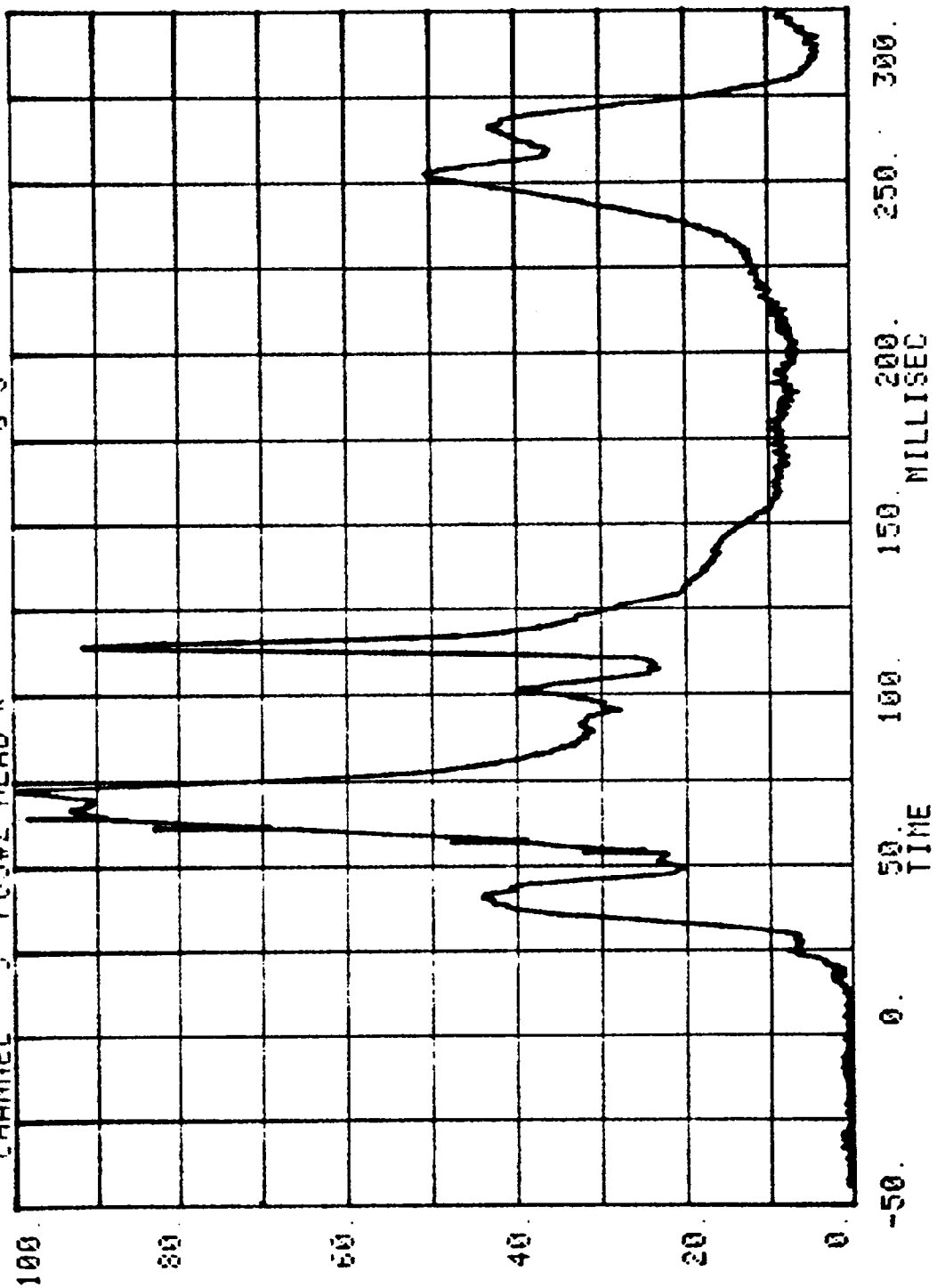
CHANNEL 14 POS#2 HEAD Y  
RUN= 941 SERIES= 5101 G'S



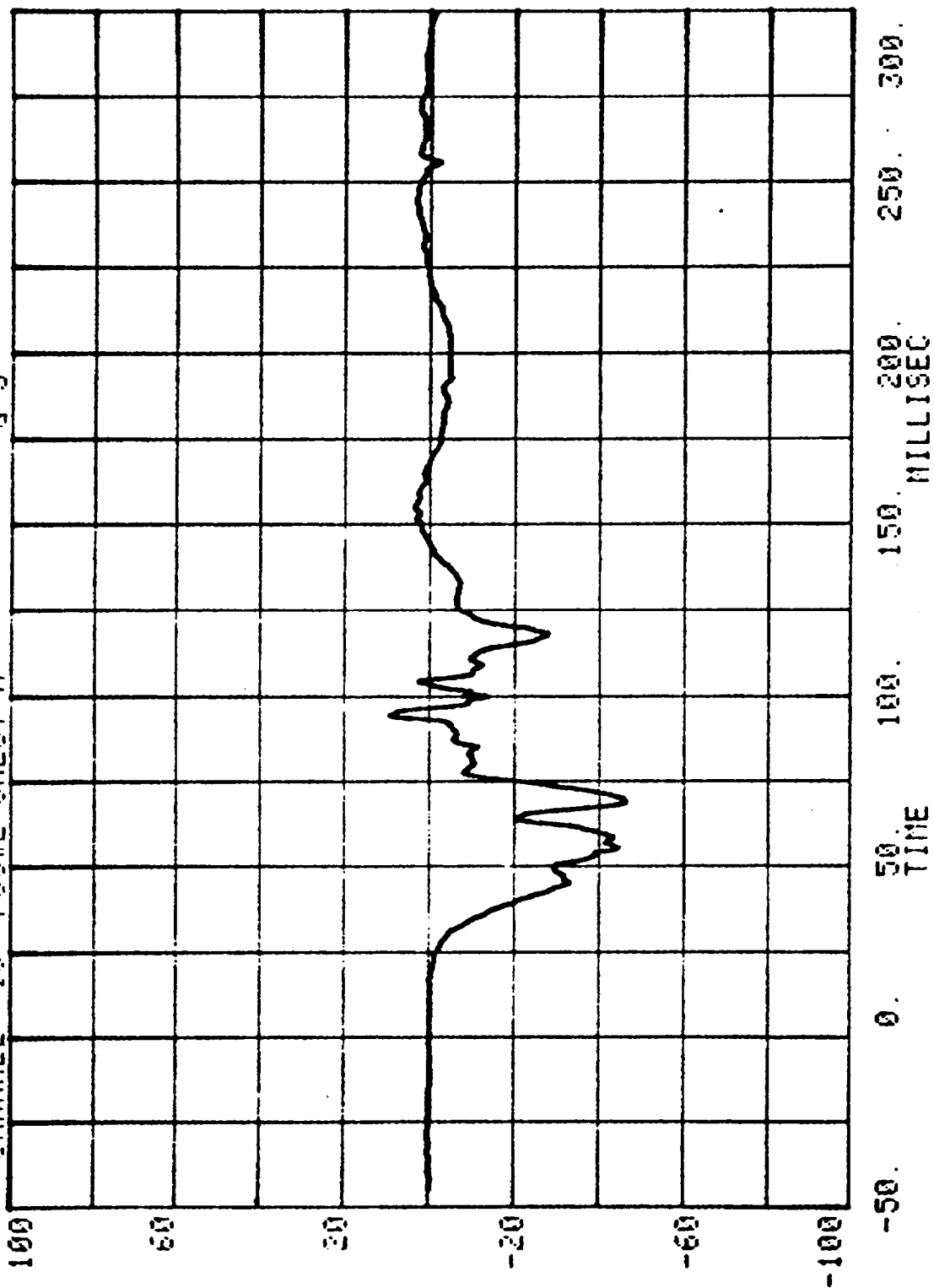
CHANNEL 15 RUN= 941 SERIES= 5101 G'S  
POS#2 HEAD Z



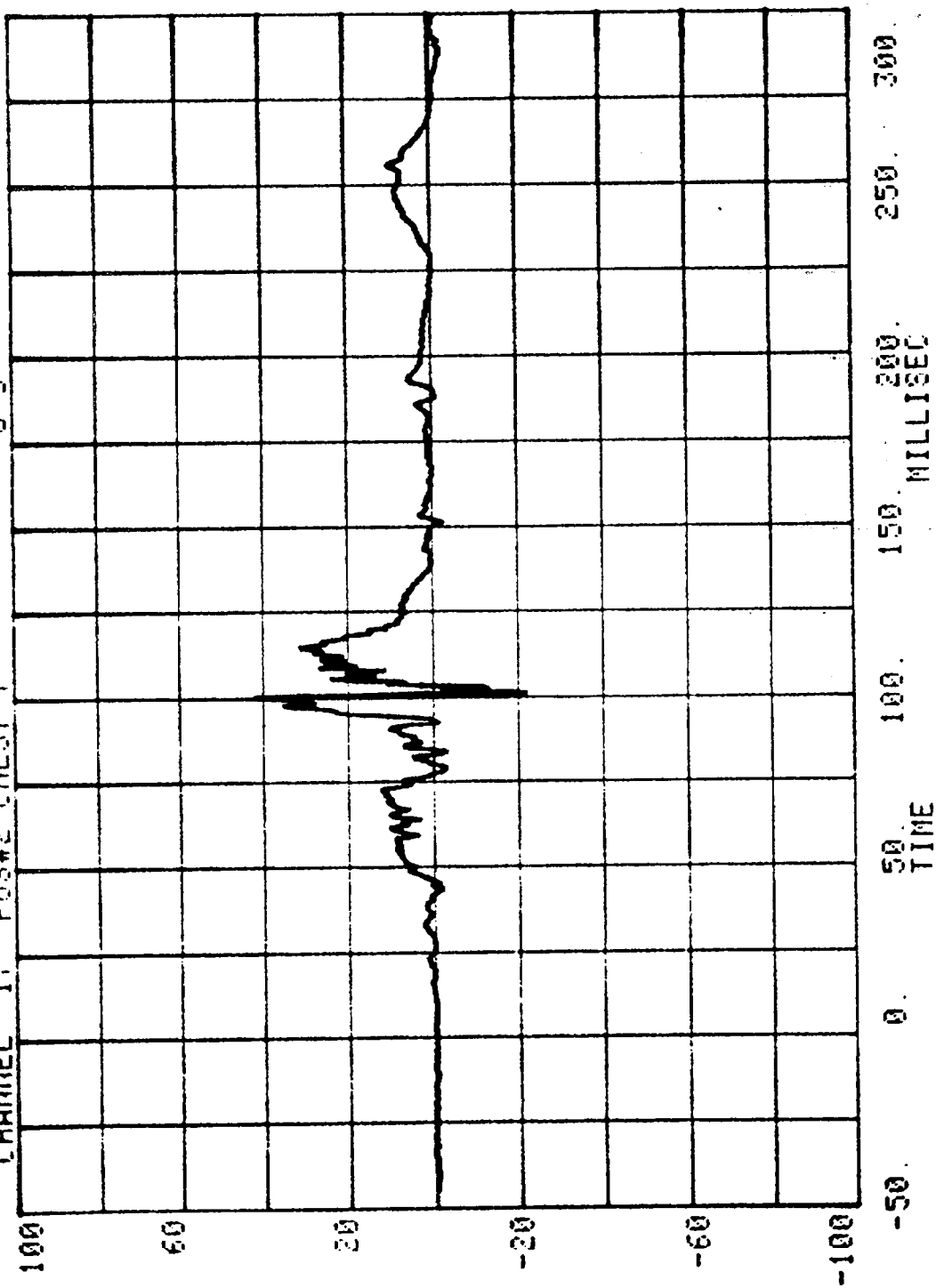
CHANNEL 3 POS#2 HEAD R RUN= 941 SERIES= 5101 G'S



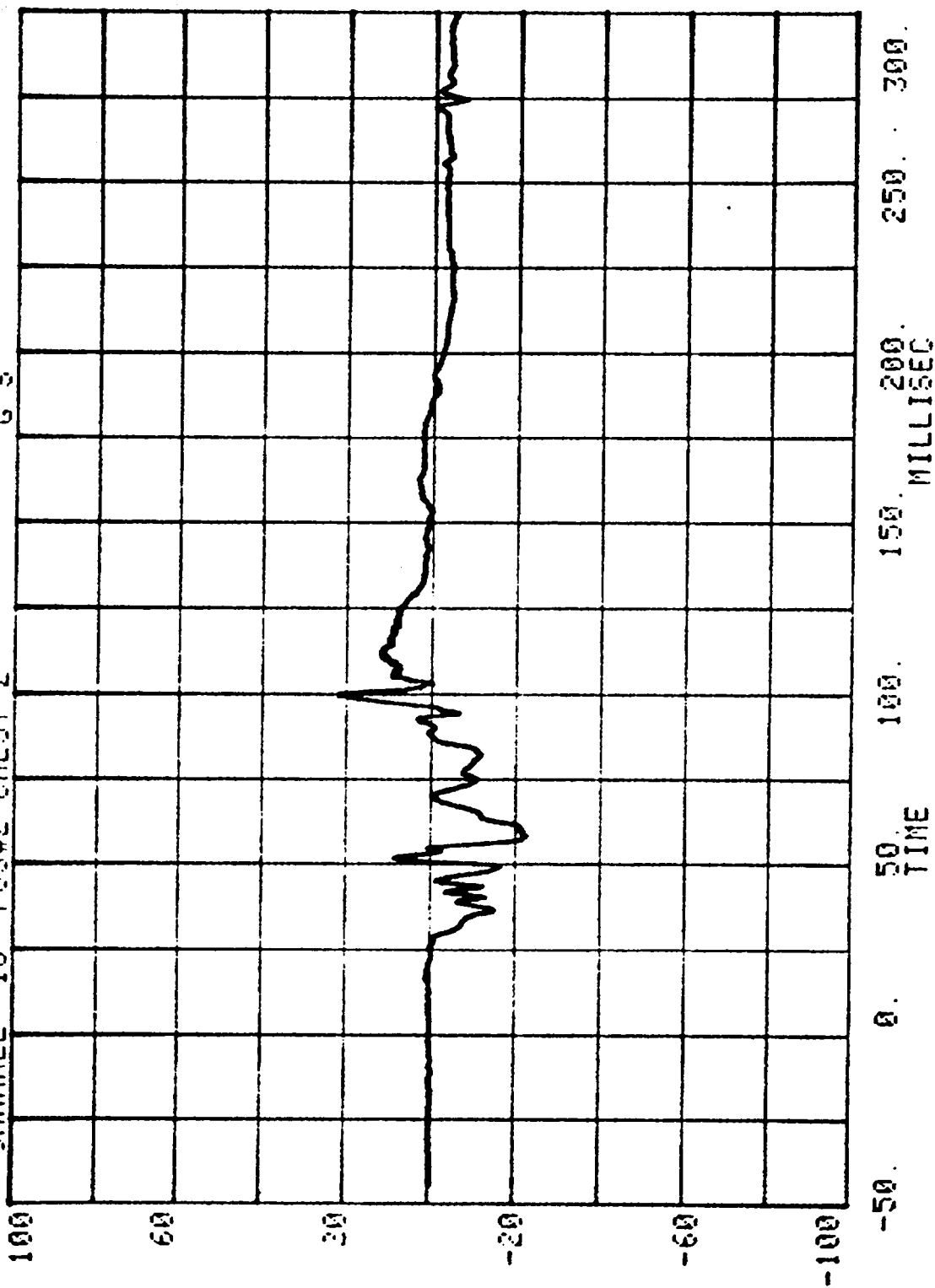
CHANNEL 16 RUN= 241 SERIES= 5101 G'S  
POS#2 CHEST X



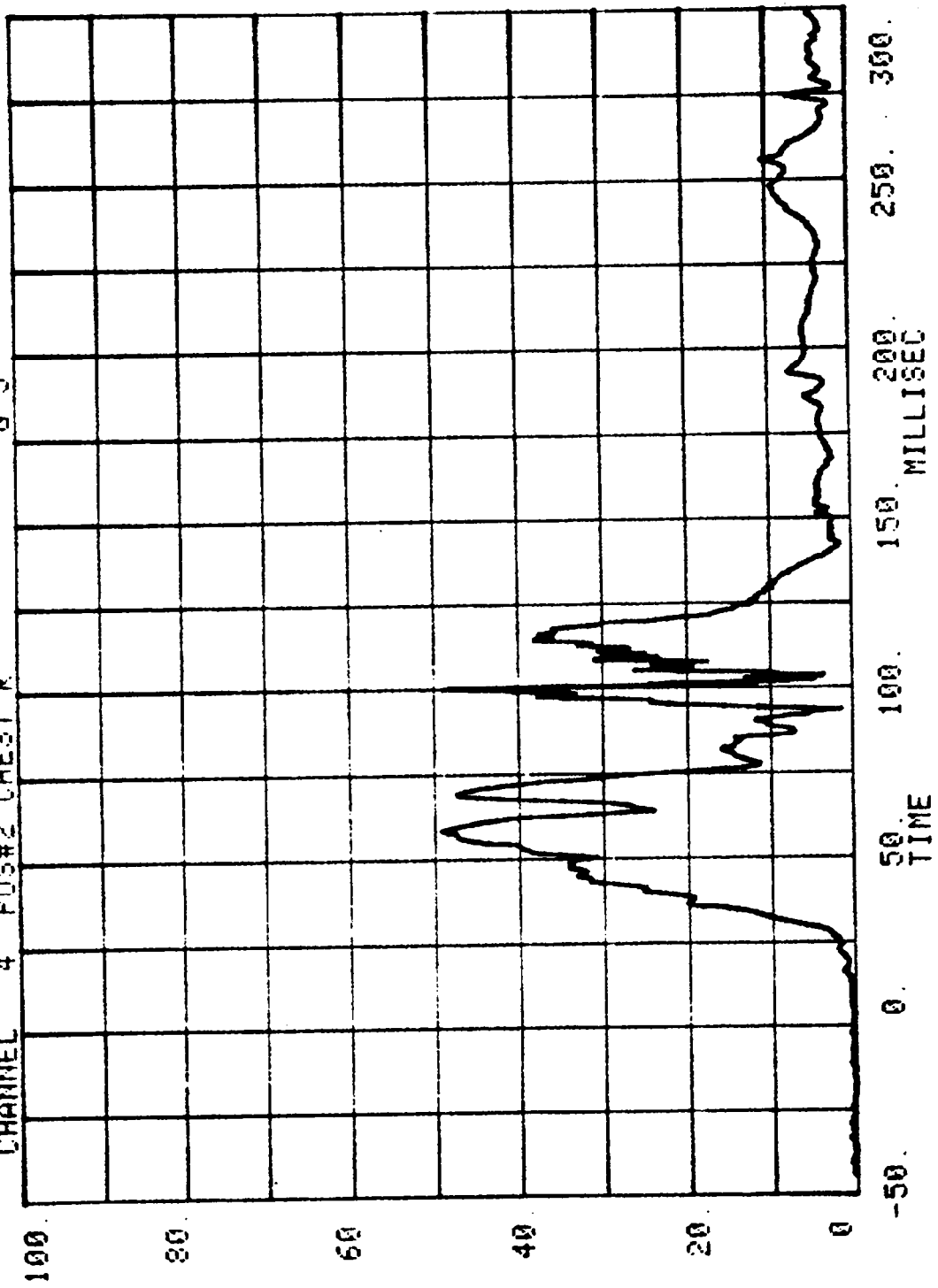
CHANNEL 17 RUN= 341 SERIES= 5101 G'S  
POS#2 CHEST Y



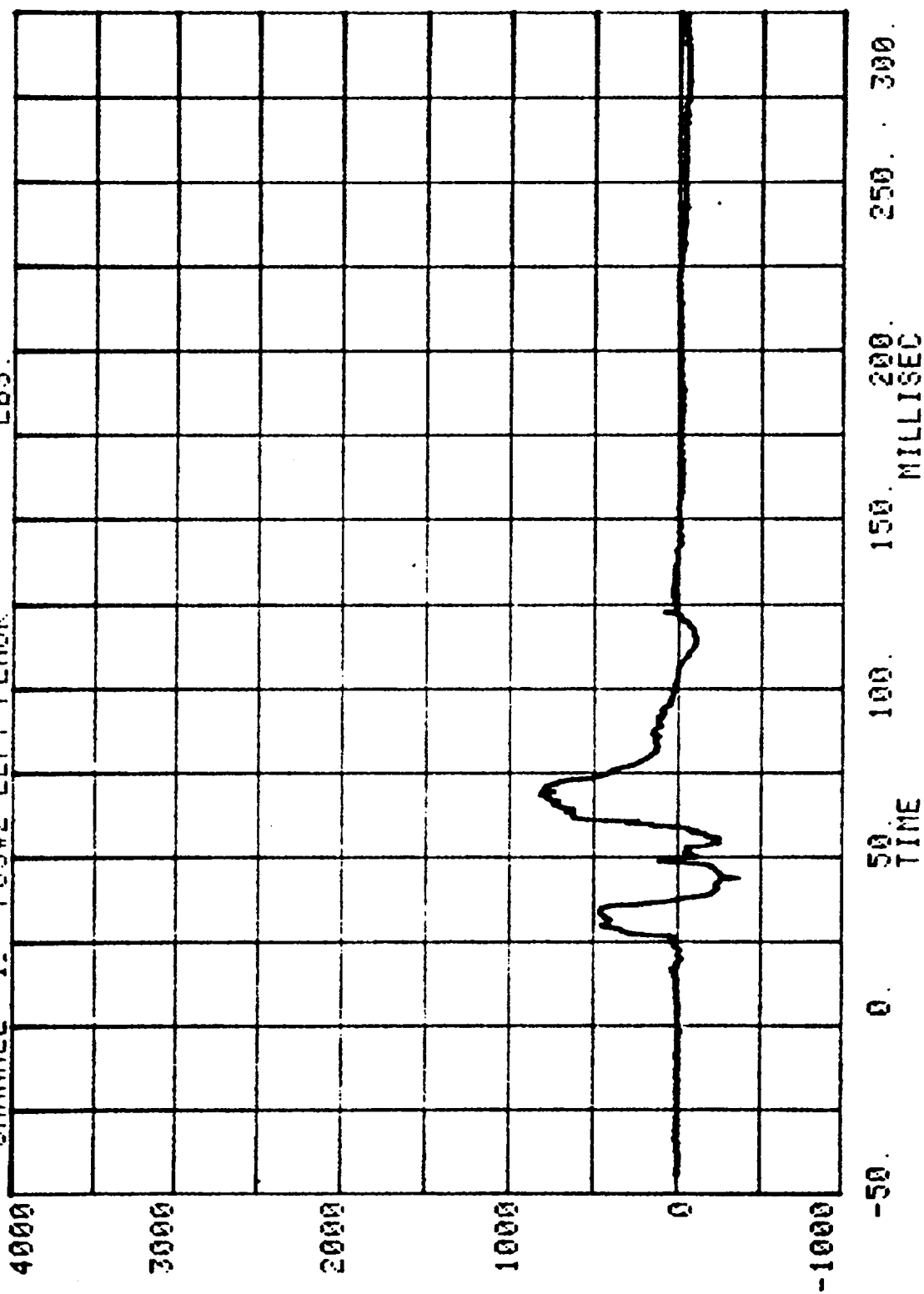
CHANNEL 18 POS#2 CHEST Z  
RUN= 941 SERIES= 5101 G'S



CHANNEL 4 POS#2 CHEST R RUH= 941 SERIES= 5101 G'S

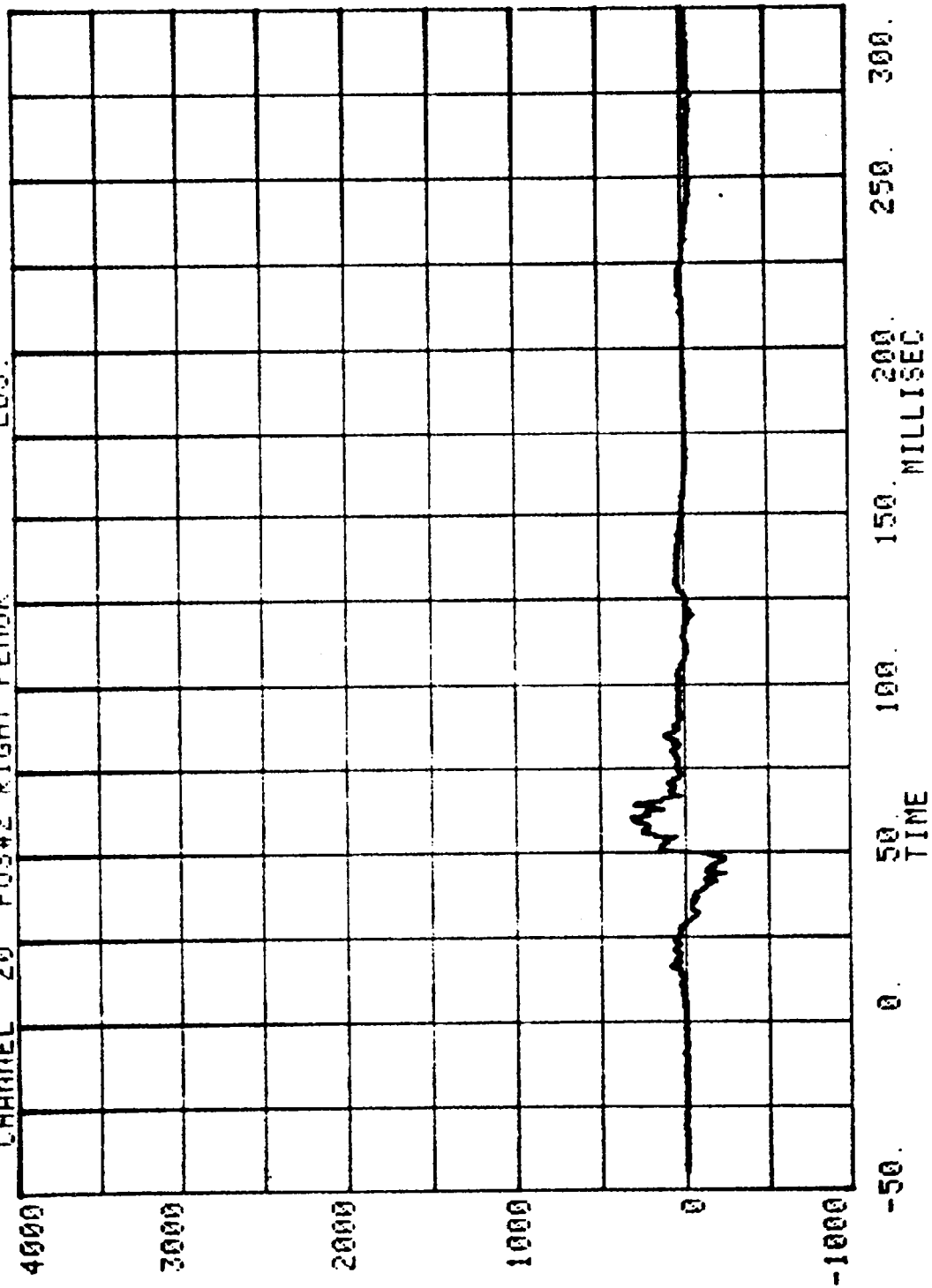


CHANNEL 12 RUN= 341 SERIES= 5101 LBS.  
POS#2 LEFT FEMUR

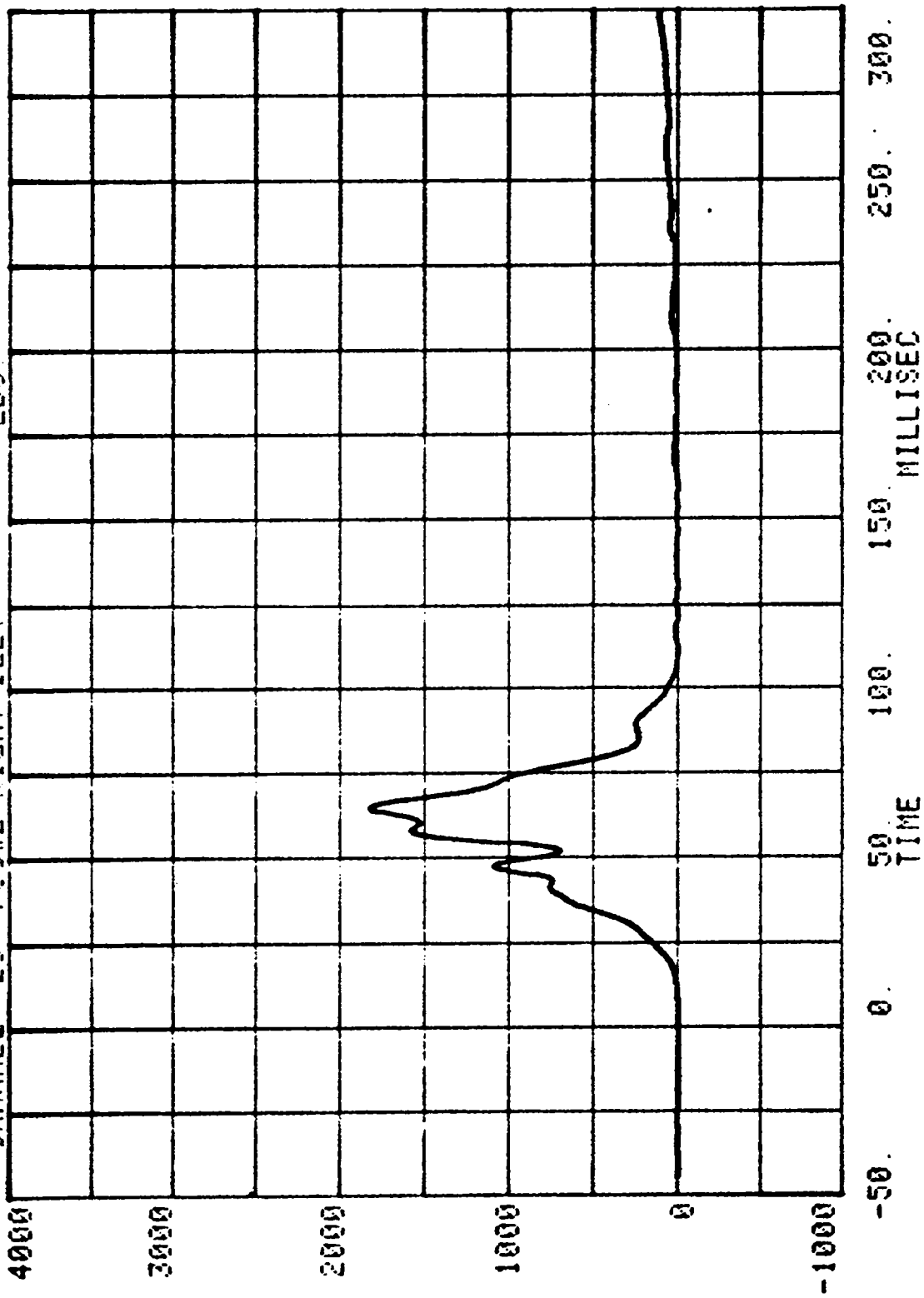


CHANNEL 20 POS#2 RIGHT FEMUR LBS.

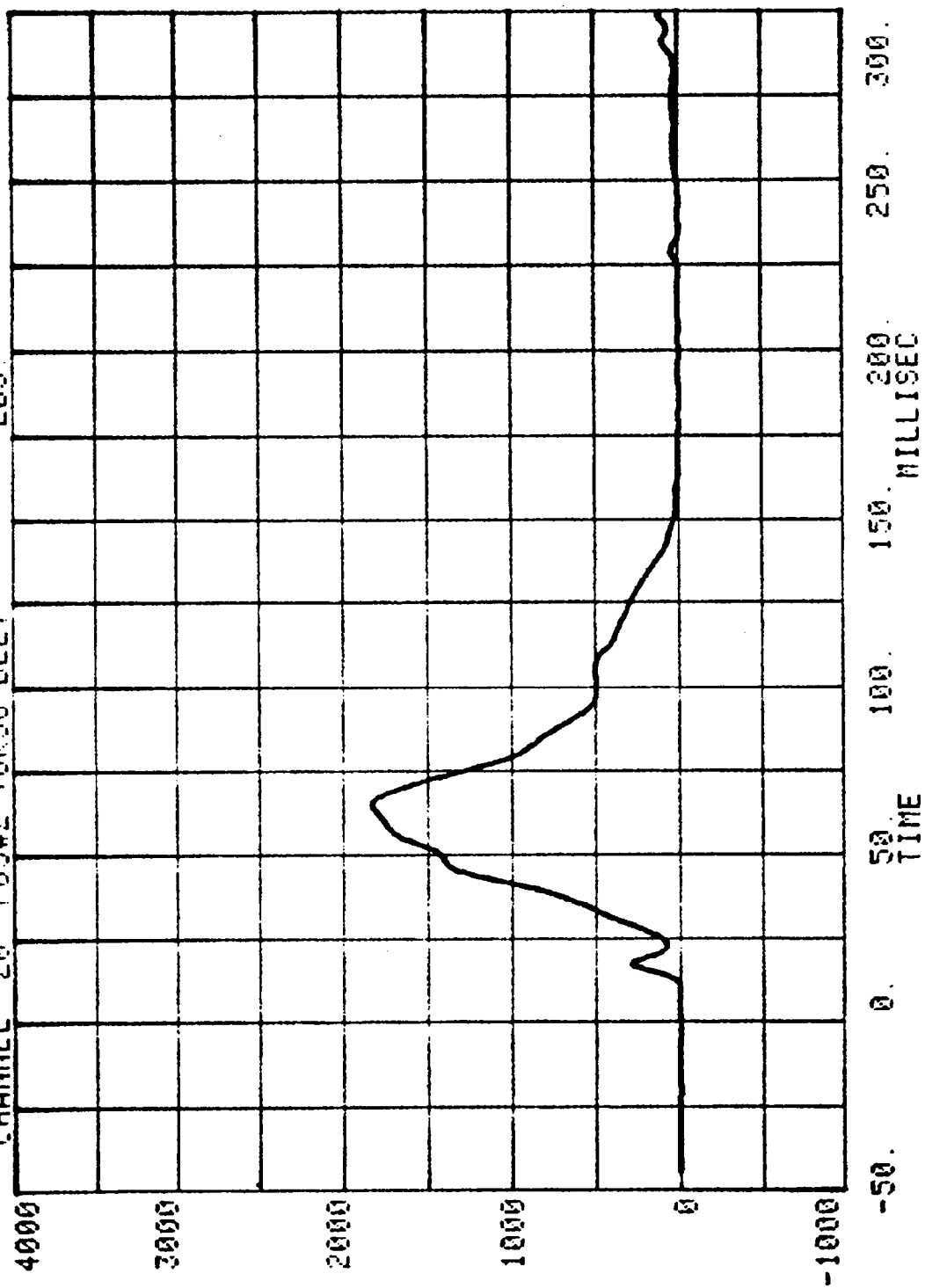
RUN= 941 SERIES= 5101



RUN= 941 SERIES= 5101  
CHANNEL 25 POS#2 RIGHT BELT LBS

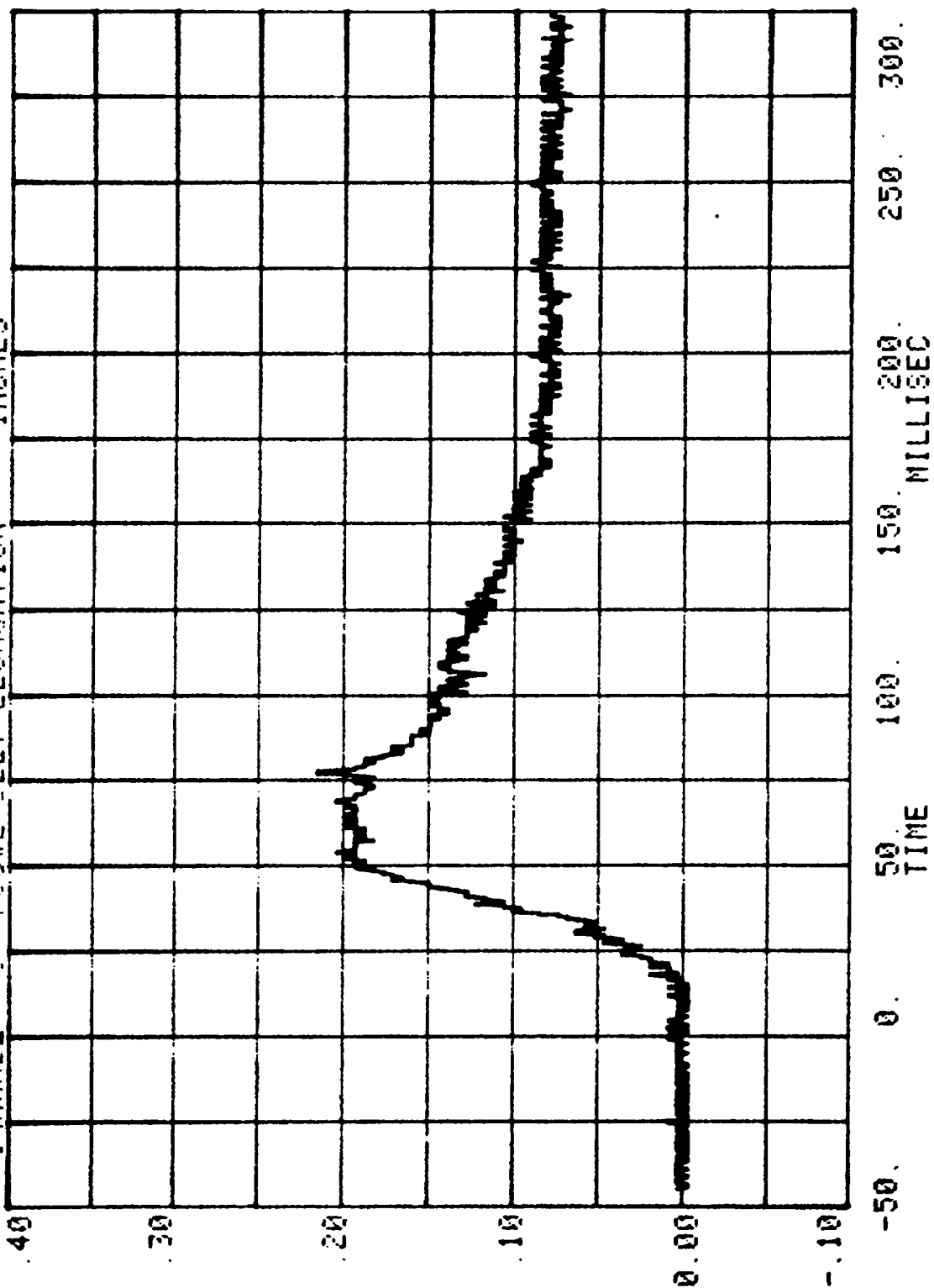


CHANNEL 26 POS#2 TORSO BELT  
RUN= 941 SERIES= 5101 LBS

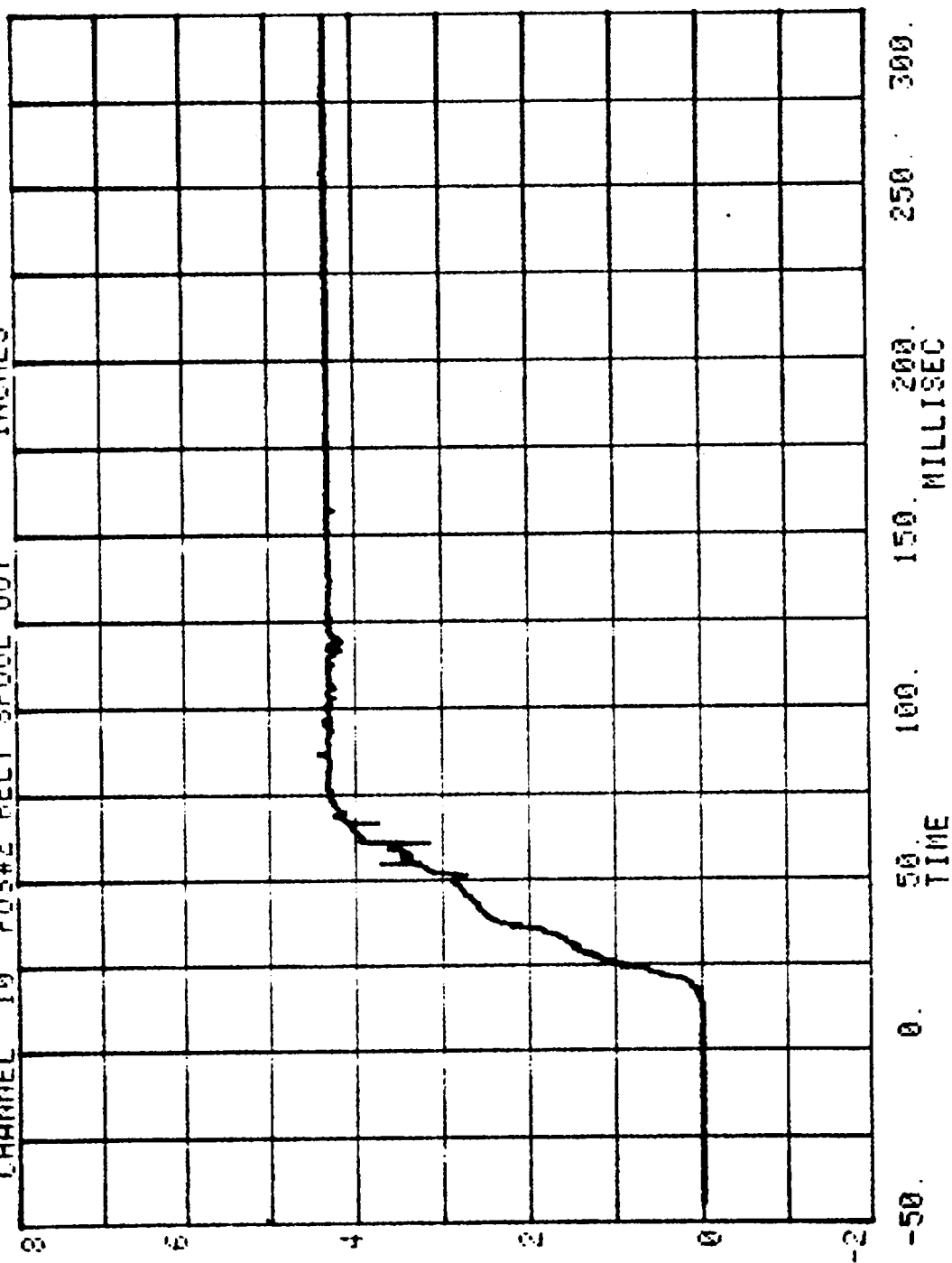


Measured over  
2.5 inches

CHANNEL 9 RUN= 941 SERIES= 5101  
PDS#2 BELT ELONGATION INCHES



CHANNEL 10 POS#2 BELT SPOOL OUT RUN= 341 SERIES= 5101 INCHES



Appendix C

DUMMY CERTIFICATION TESTS

Appendix C contains the results from certification tests performed on the 50th percentile male anthropomorphic test devices utilized for this crash test. The results indicate that the dummies meet all of the performance requirements of the six standard tests as specified in 49 CFR Part 572, Federal Register, Volume 42, No. 25, dated February 7, 1977.

The tests were conducted at the Dummy Certification Test Facility of Calspan Corporation, Advanced Technology Center. A summary of the test results, Part 572 specifications and instrument calibration information is included in this Appendix.

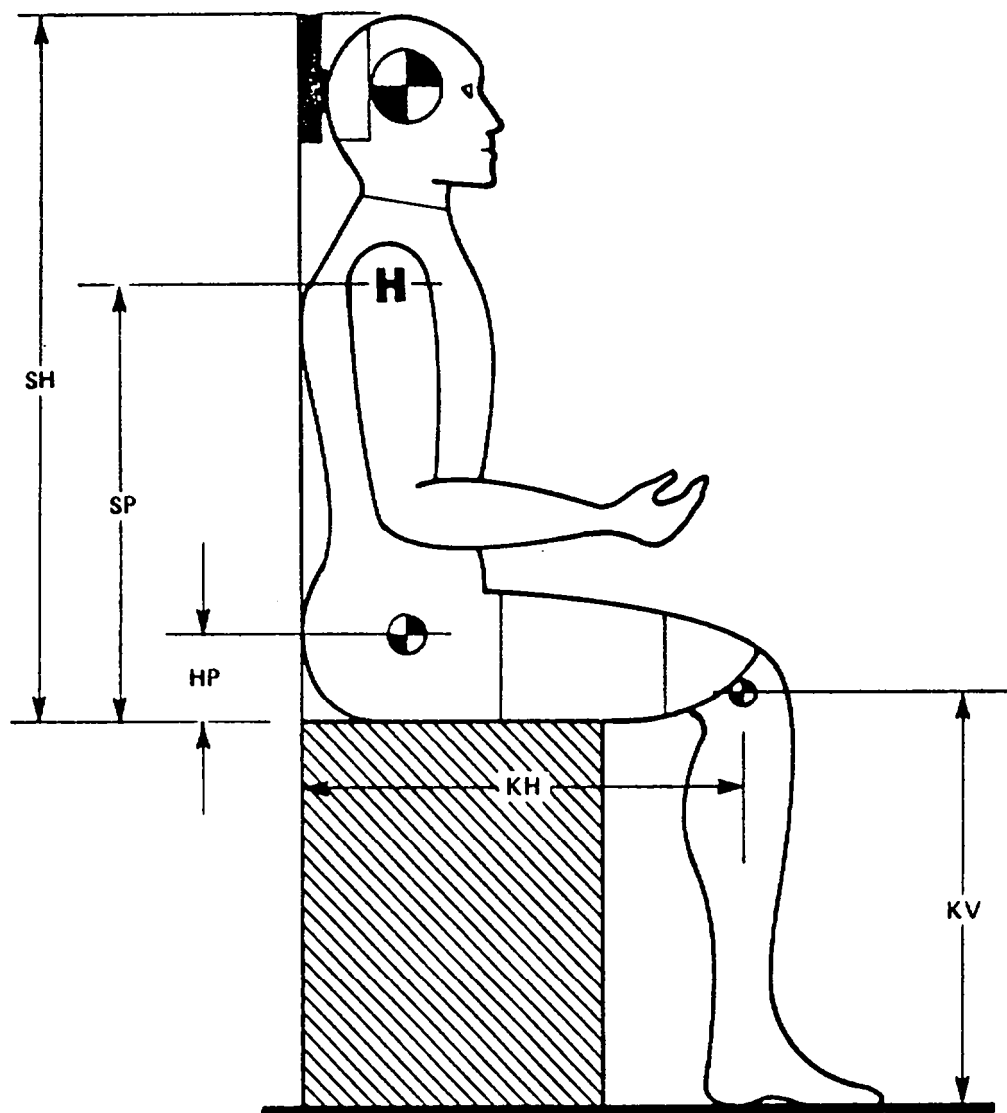
Dummy serial numbers and certification dates are:

| <u>Serial No.</u> | <u>Completion Data</u> |
|-------------------|------------------------|
| 357               | 9-14-89                |
| 358               | 9-15-89                |

#### Electronic Test Equipment

The complement of signal conditioning, recording and display equipment, in conjunction with dummy certification testing, can be found in New Car Assessment and Standards Indicant Testing Final Report No. 6525-V-1.

Figure 10 DUMMY CONFIGURATION DIMENSIONS



# PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

NHTSA DUMMY I.D. NUMBER.: 357

## I. CONFIGURATION VERIFICATION DATA

|                                    | P. 572<br>SPECIFICATION | PRE-TEST<br>if required | POST-TEST<br>if required |
|------------------------------------|-------------------------|-------------------------|--------------------------|
| DATE OF CONFIGURATION VERIFICATION | XXXXXXXXXXXXX           | 9-14-89                 |                          |
| VERIFICATION NUMBER FOR DUMMY (*)  | XXXXXXXXXXXXX           | 1                       |                          |
| SH - Seated Height                 | 35.6 to 35.8"           | 35.6 "                  | "                        |
| SP - Shoulder Pivot Height         | 21.8 to 22.4"           | 21.9 "                  | "                        |
| HP - Hip Pivot Height              | 3.9" ref.               | 3.9 "                   | "                        |
| KH - Knee Pivot from Back Line     | 20.1 to 20.7"           | 20.4 "                  | "                        |
| KV - Knee Pivot from floor         | 19.3 to 19.9"           | 19.5 "                  | "                        |
| SW - Shoulder Width                | 17.8 to 18.4"           | 18.0 "                  | "                        |
| HW - Hip Width                     | 14.0 to 15.4"           | 14.3 "                  | "                        |

## II. PERFORMANCE VERIFICATION DATA:

|                                                |                | PRE-TEST<br>(if required) | POST-TEST<br>(if required) |
|------------------------------------------------|----------------|---------------------------|----------------------------|
| DATE OF PERFORMANCE VERIFICATION               |                | 9-14-89                   |                            |
| SEQUENTIAL VERIFICATION NUMBER FOR DUMMY (*)   |                | 1                         |                            |
| VERIFICATION LAB TEMPERATURE ( 66 to 78 deg. ) |                | 69-70 deg                 | deg                        |
| VERIFICATION LAB HUMIDITY (10 TO 70 %)         |                | 41-50 %                   | %                          |
| TEST PARAMETER                                 | SPECIFICATION  |                           |                            |
| 1. HEAD DROP TEST                              |                |                           |                            |
| a. peak resultant accel.                       | 210 to 260 G's | 213 G's                   | G's                        |
| b. peak lateral accel.                         | <= 10 G's      | 1.6 G's                   | G's                        |
| c. Time above 100 G's                          | 0.9 to 1.5 ms. | 1.38 ms                   | ms                         |

\* Sequential number beginning with "1" at the start of each fiscal years's crash test program.

TECHNICIAN'S NAME: IVAN MINKEWICZ

## II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 357

|                                        |        |                   | PRE-TEST<br>(if required) | POST-TEST<br>(if required) |
|----------------------------------------|--------|-------------------|---------------------------|----------------------------|
| TEST PARAMETER                         |        |                   | SPECIFICATION             |                            |
| 2. NECK BENDING TEST                   |        |                   |                           |                            |
| a. Pendulum Speed                      |        | 21.5 to 25.5 fps. | 22.1 fps                  |                            |
| b. Pend. Avg. Decel. over<br>t3 to t2  |        | 20 to 24 G's      | 23.2 G's                  |                            |
| c. Peak Resultant Head<br>Acceleration |        | 26 G's max.       | 25 G's                    |                            |
| d. Pendulum Decel. (t2-t1)             |        | <= 3 ms.          | 2 ms                      |                            |
| e. Pendulum Decel. (t3-t2)             |        | 25 to 30 ms.      | 26 ms                     |                            |
| f. Pendulum Decel. (t4-t3)             |        | <= 10 ms.         | 3.9 ms                    |                            |
| g. Max. Head Rotation                  |        | 63 to 73 deg.     | 68 deg                    |                            |
| h. Chordal Displacement                |        |                   |                           |                            |
| HEAD ROTATION ANGLE                    |        |                   |                           |                            |
| 0 deg.                                 | Time   | -2 to 2 ms.       | 0.0 ms                    |                            |
|                                        | Displ. | -.5 to .5"        | 0.0 "                     |                            |
| 30 deg.                                | Time   | 25.6 to 34.4 ms.  | 26.5 ms                   |                            |
|                                        | Displ. | 2.1 to 3.1"       | 2.55 "                    |                            |
| 60 deg.                                | Time   | 40.3 to 51.7 ms.  | 41 ms                     |                            |
|                                        | Displ. | 4.3 to 5.3"       | 4.75 "                    |                            |
| Maximum                                | Time   | 53.2 to 66.8 ms.  | 53.7 ms                   |                            |
|                                        | Displ. | 5.0 to 6.0"       | 5.6 "                     |                            |
| 60 deg.                                | Time   | 67.0 to 83.0 ms.  | 68.1 ms                   |                            |
|                                        | Displ. | 4.3 to 5.3"       | 5.0 "                     |                            |
| 30 deg.                                | Time   | 85.4 to 104.6 ms. | 86.4 ms                   |                            |
|                                        | Displ. | 2.1 to 3.1"       | 2.55 "                    |                            |
| 0 deg.                                 | Time   | 101.0 - 123.0 ms. | 101.9 ms                  |                            |
|                                        | Displ. | -.5 to 0.5"       | 0.0 "                     |                            |

TECHNICIANS NAME: IVAN MINKEWICZ

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA (continued)

II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 357

|                           |                  | PRE-TEST<br>(if required) | POST-TEST<br>(if required) |
|---------------------------|------------------|---------------------------|----------------------------|
| TEST PARAMETER            | SPECIFICATION    |                           |                            |
| 3. ABDOMINAL COMPRESSION  |                  |                           |                            |
| TEST: (preload = 50 lbs.) |                  |                           |                            |
| a. Force @ 0.5"           | 23 to 36 lbs.    | 24 lbs                    |                            |
| b. Force @ 0.75"          | 36 to 50 lbs.    | 38 lbs                    |                            |
| c. Force @ 1.0"           | 50 to 63 lbs.    | 55 lbs                    |                            |
| d. Force @ 1.3"           | 73 to 88 lbs.    | 86 lbs                    |                            |
| 4. LUMBAR FLEXION TEST:   |                  |                           |                            |
| a. Force @ 20 deg.        | 22 to 34 lbs.    | 27.5 lbs                  |                            |
| b. Force @ 30 deg.        | 34 to 46 lbs.    | 41 lbs                    |                            |
| c. Force @ 40 deg.        | 46 to 58 lbs.    | 52.5 lbs                  |                            |
| d. Return Angle           | 12 deg. maximum  | 6 deg                     |                            |
| 5. CHEST IMPACT TESTS:    |                  |                           |                            |
| A. High Speed             |                  |                           |                            |
| (1) Probe Speed           | 21.78-22.22 fps. | 21.9 fps                  |                            |
| (2) Peak Deflection       | 1.7" maximum     | 1.5 "                     |                            |
| (3) Peak Resistive Force  | 2250 lbs maximum | 2090 lbs                  |                            |
| (4) Internal Hysteresis   | 50 to 70%        | 58.8 %                    |                            |
| B. Low Speed              |                  |                           |                            |
| (1) Probe Speed           | 13.86-14.14 fps. | 14.1 fps                  |                            |
| (2) Peak Deflection       | 1.1" maximum     | 1.05 "                    |                            |
| (3) Peak Resistive Force  | 1450 lbs maximum | 1416 lbs                  |                            |
| (4) Internal Hysteresis   | 50 to 70%        | 55.2 %                    |                            |

TECHNICIAN'S NAME: IVAN MINKIEWICZ

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA (continued)

II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 357

|                          |                  | PRE-TEST<br>(if required) | POST-TEST<br>(if required) |
|--------------------------|------------------|---------------------------|----------------------------|
| TEST PARAMETER           | SPECIFICATION    |                           |                            |
| 6. KNEE IMPACT TEST      |                  |                           |                            |
| A. Left Knee             |                  |                           |                            |
| (1) Probe Speed          | 6.76 to 7.04 fps | 7.0 fps                   |                            |
| (2) Maximum Force        | 1850 to 2500 lbs | 2046 lbs                  |                            |
| (3) Time above 1000 lbs. | 1.7 ms. minimum  | 1.75 ms                   |                            |
| B. Right Knee            |                  |                           |                            |
| (1) Probe Speed          | 6.76 to 7.04 fps | 6.83 fps                  |                            |
| (2) Maximum Force        | 1850 to 2500 lbs | 1973 lbs                  |                            |
| (3) Time Above 1000 lbs. | 1.7 ms. minimum  | 1.75 ms                   |                            |

REMARKS:

TECHNICIAN'S NAME: IVAN MINKIEWICZ

# INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NUMBER 357

| DUMMY INSTRUMENT--                           | MFG                 | SERIAL<br>NUMBER | DATE LAST<br>CALIBRATED | DATE OF NEXT<br>CALIBRATION |
|----------------------------------------------|---------------------|------------------|-------------------------|-----------------------------|
| 1. HEAD ACCELEROMETER--                      |                     |                  |                         |                             |
| HX LONGITUDINAL--                            | ENDEVCO             | CK54             | 6-89                    | 12-89                       |
| HY LATERAL--                                 | ENDEVCO             | CK78             | 6-89                    | 12-89                       |
| HZ VERTICAL--                                | ENDEVCO             | CD75             | 6-89                    | 12-89                       |
| 2. CHEST ACCELEROMETER--                     |                     |                  |                         |                             |
| CX LONGITUDINAL--                            | CEC                 | A115             | 6-89                    | 12-89                       |
| CY LATERAL--                                 | ENDEVCO             | CS09             | 6-89                    | 12-89                       |
| CZ VERTICAL--                                | CEC                 | A29              | 6-89                    | 12-89                       |
| 3. FEMUR LOAD CELLS                          |                     |                  |                         |                             |
| LEFT SIDE                                    | GSE                 | 548              | 6-89                    | 12-89                       |
| RIGHT SIDE                                   | GSE                 | 549              | 6-89                    | 12-89                       |
| CALIBRATION LABORATORY<br>INSTRUMENTS--      |                     |                  |                         |                             |
| 1. PENDULUM ACC.--                           | CEC                 | A144             | 6-89                    | 12-89                       |
| 2. TEST PROBE<br>ACCELEROMETER--             | CEC                 | A142             | 6-89                    | 12-89                       |
| 3. LUMBAR FLEXION TEST<br>PUSH FORCE GAUGE-- | TRANS-<br>DUCER INC | 20051            | 7-89                    | 1-90                        |
| 4. ABDOMINAL COMPRESS.<br>TEST FORCE GAUGE-- | BLH                 | 72952            | 7-89                    | 1-90                        |
| 5. ABDOMINAL COMPRESS.<br>TEST FORCE GAUGE-- | CIC                 | 567-11           | 7-89                    | 1-90                        |

PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

NHTSA DUMMY I.D. NUMBER.: 358

I. CONFIGURATION VERIFICATION DATA

|                                    | P. 572<br>SPECIFICATION | PRE-TEST<br>if required | POST-TEST<br>if required |
|------------------------------------|-------------------------|-------------------------|--------------------------|
| DATE OF CONFIGURATION VERIFICATION | XXXXXXXXXXXXXX          | 9-15-89                 |                          |
| VERIFICATION NUMBER FOR DUMMY (*)  | XXXXXXXXXXXXXX          | 1                       |                          |
| SH - Seated Height                 | 35.6 to 35.8"           | 35.6 "                  | "                        |
| SP - Shoulder Pivot Height         | 21.8 to 22.4"           | 22.1 "                  | "                        |
| HP - Hip Pivot Height              | 3.9" ref.               | 3.9 "                   | "                        |
| KH - Knee Pivot from Back Line     | 20.1 to 20.7"           | 20.5 "                  | "                        |
| KV - Knee Pivot from floor         | 19.3 to 19.9"           | 19.6 "                  | "                        |
| SW - Shoulder Width                | 17.8 to 18.4"           | 18.0 "                  | "                        |
| HW - Hip Width                     | 14.0 to 15.4"           | 14.8 "                  | "                        |

II. PERFORMANCE VERIFICATION DATA:

|                                                |                | PRE-TEST<br>(if required) | POST-TEST<br>(if required) |
|------------------------------------------------|----------------|---------------------------|----------------------------|
| DATE OF PERFORMANCE VERIFICATION               |                | 9-15-89                   |                            |
| SEQUENTIAL VERIFICATION NUMBER FOR DUMMY (*)   |                | 1                         |                            |
| VERIFICATION LAB TEMPERATURE ( 66 to 78 deg. ) |                | 69-70 deg                 | deg                        |
| VERIFICATION LAB HUMIDITY (10 TO 70 %)         |                | 44-50 %                   | %                          |
| TEST PARAMETER                                 | SPECIFICATION  |                           |                            |
| 1. HEAD DROP TEST                              |                |                           |                            |
| a. peak resultant accel.                       | 210 to 260 G's | 224 G's                   | G's                        |
| b. peak lateral accel.                         | <= 10 G's      | 4.2 G's                   | G's                        |
| c. Time above 100 G's                          | 0.9 to 1.5 ms. | 1.25 ms                   | ms                         |

\* Sequential number beginning with "1" at the start of each fiscal years's crash test program.

TECHNICIAN'S NAME: IVAN MINKIEWICZ

## PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA...continued

## II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 35B

| TEST PARAMETER                         |        | SPECIFICATION     | PRE-TEST<br>(if required) | POST-TEST<br>(if required) |
|----------------------------------------|--------|-------------------|---------------------------|----------------------------|
| 2. NECK BENDING TEST                   |        |                   |                           |                            |
| a. Pendulum Speed                      |        | 21.5 to 25.5 fps. | 22.1 fps                  |                            |
| b. Pend. Avg. Decel. over<br>t3 to t2  |        | 20 to 24 G's      | 23.9 G's                  |                            |
| c. Peak Resultant Head<br>Acceleration |        | 26 G's max.       | 25.69 G's                 |                            |
| d. Pendulum Decel. (t2-t1)             |        | <= 3 ms.          | 2.36 ms                   |                            |
| e. Pendulum Decel. (t3-t2)             |        | 25 to 30 ms.      | 26.04 ms                  |                            |
| f. Pendulum Decel. (t4-t3)             |        | <= 10 ms.         | 3.84 ms                   |                            |
| g. Max. Head Rotation                  |        | 63 to 73 deg.     | 66.6 deg                  |                            |
| h. Chordal Displacement                |        |                   |                           |                            |
| HEAD ROTATION ANGLE                    |        |                   |                           |                            |
| 0 deg.                                 | Time   | -2 to 2 ms.       | 0.0 ms                    |                            |
|                                        | Displ. | -.5 to .5"        | 0.0 "                     |                            |
| 30 deg.                                | Time   | 25.6 to 34.4 ms.  | 26.29 ms                  |                            |
|                                        | Displ. | 2.1 to 3.1"       | 2.41 "                    |                            |
| 60 deg.                                | Time   | 40.3 to 51.7 ms.  | 41.42 ms                  |                            |
|                                        | Displ. | 4.3 to 5.3"       | 4.99 "                    |                            |
| Maximum                                | Time   | 53.2 to 66.8 ms.  | 54.0 ms                   |                            |
|                                        | Displ. | 5.0 to 6.0"       | 5.78 "                    |                            |
| 60 deg.                                | Time   | 67.0 to 83.0 ms.  | 67.83 ms                  |                            |
|                                        | Displ. | 4.3 to 5.3"       | 4.96 "                    |                            |
| 30 deg.                                | Time   | 85.4 to 104.6 ms. | 86.43 ms                  |                            |
|                                        | Displ. | 2.1 to 3.1"       | 2.11 "                    |                            |
| 0 deg.                                 | Time   | 101.0 - 123.0 ms. | 101.19 ms                 |                            |
|                                        | Displ. | -.5 to 0.5"       | 0.0 "                     |                            |

TECHNICIANS NAME: IVAN MINKEWICZ

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA (continued)

11. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 358

|                           |                  | PRE-TEST<br>(if required) | POST-TEST<br>(if required) |
|---------------------------|------------------|---------------------------|----------------------------|
| TEST PARAMETER            | SPECIFICATION    |                           |                            |
| 3. ABDOMINAL COMPRESSION  |                  |                           |                            |
| TEST: (preload = 50 lbs.) |                  |                           |                            |
| a. Force @ 0.5"           | 23 to 36 lbs.    | 26 lbs                    |                            |
| b. Force @ 0.75"          | 36 to 50 lbs.    | 39.5 lbs                  |                            |
| c. Force @ 1.0"           | 50 to 63 lbs.    | 55 lbs                    |                            |
| d. Force @ 1.3"           | 73 to 88 lbs.    | 79 lbs                    |                            |
| 4. LUMBAR FLEXION TEST:   |                  |                           |                            |
| a. Force @ 20 deg.        | 22 to 34 lbs.    | 27 lbs                    |                            |
| b. Force @ 30 deg.        | 34 to 46 lbs.    | 38 lbs                    |                            |
| c. Force @ 40 deg.        | 46 to 58 lbs.    | 51.5 lbs                  |                            |
| d. Return Angle           | 12 deg. maximum  | 11 deg                    |                            |
| 5. CHEST IMPACT TESTS:    |                  |                           |                            |
| A. High Speed             |                  |                           |                            |
| (1) Probe Speed           | 21.78-22.22 fps. | 21.9 fps                  |                            |
| (2) Peak Deflection       | 1.7" maximum     | 1.49 "                    |                            |
| (3) Peak Resistive Force  | 2250 lbs maximum | 2073 lbs                  |                            |
| (4) Internal Hysteresis   | 50 to 70%        | 63.4 %                    |                            |
| B. Low Speed              |                  |                           |                            |
| (1) Probe Speed           | 13.86-14.14 fps. | 14.1 fps                  |                            |
| (2) Peak Deflection       | 1.1" maximum     | 1.07 "                    |                            |
| (3) Peak Resistive Force  | 1450 lbs maximum | 1414 lbs                  |                            |
| (4) Internal Hysteresis   | 50 to 70%        | 58.7 %                    |                            |

TECHNICIAN'S NAME: IVAN MINKEWICZ

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA (continued)

II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 358

|                          |                  | PRE-TEST<br>(if required) | POST-TEST<br>(if required) |
|--------------------------|------------------|---------------------------|----------------------------|
| TEST PARAMETER           | SPECIFICATION    |                           |                            |
| 6. KNEE IMPACT TEST      |                  |                           |                            |
| A. Left Knee             |                  |                           |                            |
| (1) Probe Speed          | 6.76 to 7.04 fps | 7.0 fps                   |                            |
| (2) Maximum Force        | 1850 to 2500 lbs | 2287 lbs                  |                            |
| (3) Time above 1000 lbs. | 1.7 ms. minimum  | 1.75 ms                   |                            |
| B. Right Knee            |                  |                           |                            |
| (1) Probe Speed          | 6.76 to 7.04 fps | 7.0 fps                   |                            |
| (2) Maximum Force        | 1850 to 2500 lbs | 1995 lbs                  |                            |
| (3) Time Above 1000 lbs. | 1.7 ms. minimum  | 1.75 ms                   |                            |

REMARKS:

TECHNICIAN'S NAME: IVAN MINKIEWICZ

# INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NUMBER \_\_\_\_\_358\_\_\_\_\_

| DUMMY INSTRUMENT--                           | MFG                 | SERIAL<br>NUMBER | DATE LAST<br>CALIBRATED | DATE OF NEXT<br>CALIBRATION |
|----------------------------------------------|---------------------|------------------|-------------------------|-----------------------------|
| 1. HEAD ACCELEROMETER--                      |                     |                  |                         |                             |
| HX LONGITUDINAL--                            | ENDEVCO             | EL86             | 10-89                   | 4-90                        |
| HY LATERAL--                                 | ENDEVCO             | FR42             | 10-89                   | 4-90                        |
| HZ VERTICAL--                                | ENDEVCO             | GD35             | 10-89                   | 4-90                        |
| 2. CHEST ACCELEROMETER--                     |                     |                  |                         |                             |
| CX LONGITUDINAL--                            | CEC                 | A150             | 6-89                    | 12-89                       |
| CY LATERAL--                                 | ENDEVCO             | CH35             | 6-89                    | 12-89                       |
| CZ VERTICAL--                                | CEC                 | A151             | 6-89                    | 12-89                       |
| 3. FEMUR LOAD CELLS                          |                     |                  |                         |                             |
| LEFT SIDE                                    | GSE                 | 551              | 6-89                    | 12-89                       |
| RIGHT SIDE                                   | GSE                 | 552              | 6-89                    | 12-89                       |
| CALIBRATION LABORATORY<br>INSTRUMENTS--      |                     |                  |                         |                             |
| 1. PENDULUM ACC.--                           | CEC                 | A144             | 6-89                    | 12-89                       |
| 2. TEST PROBE<br>ACCELEROMETER--             | CEC                 | A142             | 6-89                    | 12-89                       |
| 3. LUMBAR FLEXION TEST<br>PUSH FORCE GAUGE-- | TRANS-<br>DUCER INC | 20051            | 7-89                    | 1-90                        |
| 4. ABDOMINAL COMPRESS.<br>TEST FORCE GAUGE-- | BLH                 | 72952            | 7-89                    | 1-90                        |
| 5. ABDOMINAL COMPRESS.<br>TEST FORCE GAUGE-- | CIC                 | 567-11           | 7-89                    | 1-90                        |

Appendix D

VEHICLE OWNER'S MANUAL OCCUPANT RESTRAINT SYSTEM INSTRUCTIONS

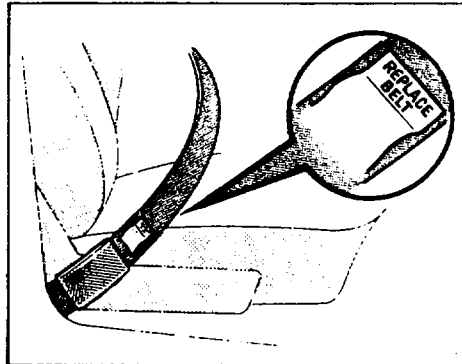
**—Seat belt precautions**

**Pregnant woman.** Toyota recommends the use of a seat belt. Ask your doctor for specific recommendations. The lap belt should be worn securely and as low as possible over the hips and not on the waist.

- Be careful not to damage the belt webbing or hardware, and take care that they do not get caught or pinched in the seat or doors.

- After adjusting the headrest, make sure it is locked in position.
- Do not drive with the headrests removed.

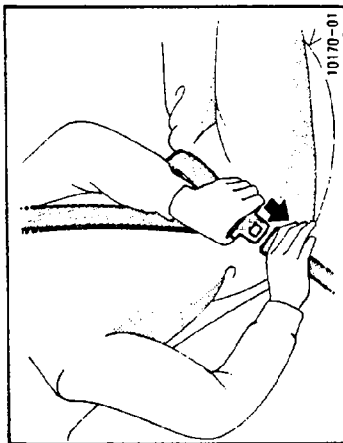
- **Inspect the belt system periodically. Check for cuts, frays, and loose parts. Damaged parts should be replaced. Do not disassemble or modify the system.**
- **Keep the belts clean and dry. If they need cleaning, use a mild soap solution or lukewarm water. Never use bleach, dye, or abrasive cleaners—they may severely weaken the belts.**
- **Replace the belt assembly if it has been used in a severe impact. The entire assembly should be replaced even if damage is not obvious.**



- **Replace the seat belt if the warning label under the sleeve can be seen. The warning label, "REPLACE BELT", will appear if the belt receives a severe impact or other force.**

|||||

—3-point type

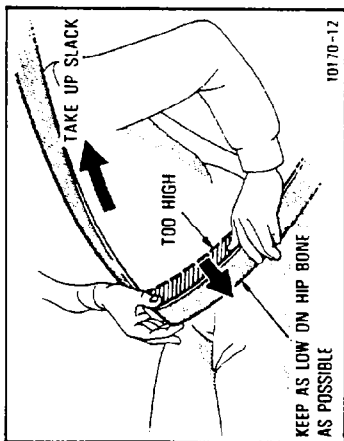


Adjust the seat as needed and sit well back in the seat and straight up. To fasten your belt, pull it out of the retractor and insert the tab into the buckle.

You will hear a click when the tab locks into the buckle.

The seat belt length automatically adjusts to your size and the seat position.

The retractor will lock the belt during a sudden stop or on impact. At other times you can move around freely.

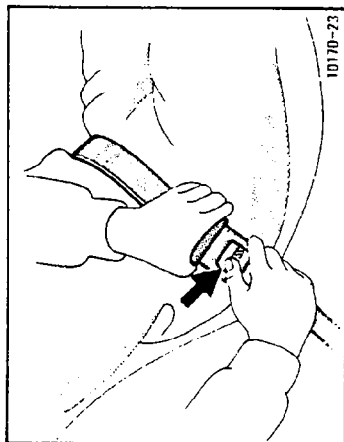


Adjust the position of the lap and shoulder belts.

Position the lap belt as low as possible on your hips—not on your waist, then adjust it to a snug fit by pulling the shoulder portion upward through the latch plate.

**CAUTION:** High-positioned lap belts and loose-fitting shoulder belts both could increase the chance of injury due to sliding under the lap belt during an accident.

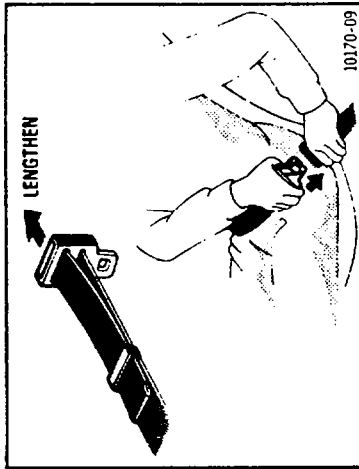
For your safety, do not place the shoulder belt under your arm.



To release the belt, press the buckle-release button and allow the belt to retract.

If the belt does not smoothly retract, pull it out and check for kinks or twists. Then make sure that it remains untwisted as it retracts.

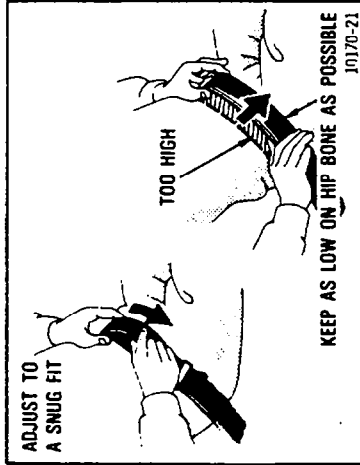
**-2-point type**



Sit well back in the seat and straight up. To fasten your belt, insert the tab into the buckle.

You will hear a click when the tab locks into the buckle.

If the belt is not long enough for you, hold the tab at a right angle to the belt and pull on the tab.



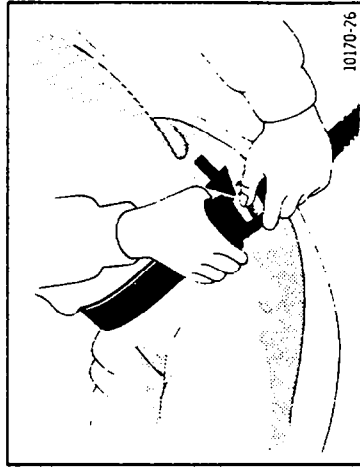
Remove excess length of the belt and adjust the belt position.

To shorten the belt, pull the free end of the belt.

Position the lap belt as low as possible on your hips—not on your waist, then adjust it to a snug fit.

**CAUTION:**

**High-positioned lap belts could increase the chance of injury due to sliding under the lap belt during an accident.**



To release the belt, press the buckle-release button.